

# NATIONAL BUILDING RESEARCH ORGANISATION

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# 2019 ANNUAL REPORT

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Ministry of Defence



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The Annual Report 2019 was approved by the NBRO Interim Management Committee (IMC) on its meeting held on 24<sup>th</sup> February 2020

## About NBRO

National Building Research Organisation (NBRO) was formed on 5<sup>th</sup> March 1984 following a Cabinet Decision taken on 29<sup>th</sup> September 1983. Today, after nearly 36 years in existence, the NBRO stands out as a leading R & D institution, a reputed technical service provider and the national focal point for landslide risk management.

NBRO is truly a multi-disciplinary institution, where technical experts from various disciplines team up and offer R&D, technical consultancy and testing services through its six technical divisions namely, Building Materials Research and Testing Division, Environmental Studies and Services Division, Geotechnical Engineering & Testing Division, Human Settlements Planning and Training Division, Landslide Research and Risk Management Division and Project Management Division. The three ISO-accredited laboratories, Administration Division, Finance Division, ICT & Program Unit and Internal Audit Unit support its functioning.

People seek NBRO assistance when confronted with a diversity of problems in their living environment, be that due to rumbling mountains, soft grounds, polluted air, contaminated water, poor construction and substandard building materials etc. NBRO as a dutiful service provider is always geared up to provide suitable solutions to maintain and improve the quality of life of all citizens.

NBRO carries out identification, risk assessment, hazard zonation mapping, monitoring, early warning, mitigation and awareness building related to landslides and in addition, issues Landslide Risk Assessment Reports (LRAR) for all construction and development activities in landslide-prone areas in the country as the mandated institution for landslide risk management in Sri Lanka.

NBRO is a self-funded institution and earns sufficient revenue to meet its recurrent expenditure. NBRO provides testing and technical consultancy services to the general public, public sector institutions, private companies and international institutions. With the support of its fully-equipped soil-testing laboratory and drilling equipment NBRO conducts geotechnical engineering investigations as a consultancy service, and investigations of most large infrastructure development and landslide mitigation projects in the country had been performed by NBRO. In addition, testing of building materials for suitability in construction and certification, disaster risk assessment, environmental quality assessment of water, wastewater, soil, sediment, air and emissions ensuring safety of humans and environment, and related studies leading to impact studies and status management are offered as technical consultancy services by NBRO and these bring in NBRO its much needed revenue. NBRO also offers consultancy services on project management of construction projects and also a unique service of condition reporting of buildings. Human settlements planning and developing cost-effective disaster-resilient housing are yet more services offered by NBRO.

## Executive Report



**N**BRO continued staying at the forefront as a leading and efficient government institution, while continuing to fulfil its duties and responsibilities fully and to the best of its ability. In spite of challenges faced from time to time, NBRO continued to accomplish assigned tasks on time and perform financially well ensuring institutional stability. In consideration, I take great privilege to compile and present this Annual Report and the Financial Statement of NBRO for the year ended on 31st December 2019.

NBRO embarked on several large projects as Disaster Risk Reduction measures, initiating them in 2018 and commencing project implementation in 2019. NBRO plans the project completion within the coming 2 to 3-year period. AIIB-assisted Reduction of Landslide Vulnerability by Mitigation Measures Project is by far the first mega project NBRO has undertaken to implement. Resettlement in disaster-affected families is yet another large project. These NBRO projects together will escalate its annual turnover many folds, taking NBRO to a much higher scale of operation.

In 2019, NBRO recorded high turnover of Rs. 959.0 Mn in spite of the stiff competition NBRO faced from competitive agencies for testing and consultancy services. This turn over resulted in the profit of Rs. 55.2 Mn.

NBRO continued to increase technical consultancy services to provide better service to customers. Private institutions and other

competing public institutions continued to offer stiff competition when procuring technical consultancy and testing services. The total income from provision of testing & consultancy work is Rs. 618.8 Mn.

NBRO thrived to assure the quality and timely delivery of outputs of technical consultancy and testing work. This always seems to give NBRO a leading edge when procuring competitive contracts. Further, as a measure of maintaining high standards, NBRO has all the three laboratories accredited to ISO 17025 and continued all internal and external audits on time and supported by having further training programmes for staff.

NBRO further wishes to expand its scope in quality management through accreditation to ISO 17065 as a certification body and to ISO 17020 as an inspection body. Preliminary work for such accreditation has been started at NBRO and prospective clients from industry have been apprised.

Increasing workload required recruitment of more staff and as per the approved cadre and requirements of projects undertaken, staff was recruited. By the end of December 2019, the staff strength increased from 483 to 490, which once again is the highest number of total staff strength recorded at NBRO so far.

NBRO continued in 2019 to give prominence to safety at work as a result of which, accidents and emergencies at its offices, laboratories and work sites are very low. Wearing personnel protection equipment and using other safety gear at work are practiced by NBRO staff. Effort will be taken always to maintain a high level of work safety.

NBRO holds an Industry Consultation Meeting with stakeholders to obtain their research needs and incorporates them in its Research and Development programme. In 2019, NBRO received LKR 15.0 Mn. as the

annual government research allocation that was utilized in the R&D Programme. NBRO also received Rs. 25.0 Mn for procuring laboratory and field equipment for research purposes. The R&D studies were conducted covering a wide range of subject areas and details are given under the Research & Development Programme in this report.

NBRO conducted many training and awareness-building programmes in 2019 on disaster resilient construction raising awareness among government officers, recipients of houses in resettlement programmes, constructional personnel, school and university students and officers from private and non-governmental organizations.

### **CONTRIBUTION TOWARDS NATIONAL DEVELOPMENT**

NBRO carries out an important duty as the national focal point for landslide studies. Hazard and risk maps are produced and used in the national physical planning and development activities. Issuing of early warning is a very important duty carried out by NBRO.

NBRO as an assigned duty, issues Landslide Risk Assessment Reports (LRAR) with technical recommendations to local government bodies for granting approval for construction or development activities in landslide hazard-prone areas. In 2019, the Cabinet approved declaration of 4 more districts as landslide-prone districts making total of landslide-prone districts to 14. NBRO has altogether 10 district offices that issue these reports. In 2019, 7601 reports were issued after necessary investigations.

The JICA, the World Bank, Asian Disaster Preparedness Centre (ADPC), Norwegian Geotechnical Institute (NGI), and Asian Infrastructure Investment Bank (AIIB) continued to extend their assistance to NBRO in 2019. More institutions such as United States Geological Society, Bath University, and University of Salford offered their assistance to NBRO and Memoranda of Understanding were signed to this effect.

NBRO continued to implement landslide mitigation work. These works include mitigation of identified potentially hazardous landslides that threaten settlements, and the stabilization of roadside slopes, identified unstable slopes close to rail tracks and slopes around schools and vulnerable public buildings.

NBRO invested some of its own surplus funds in urgent disaster response and in public awareness work as a corporate social responsibility.

### **EXTENDING NBRO EXPERTISE**

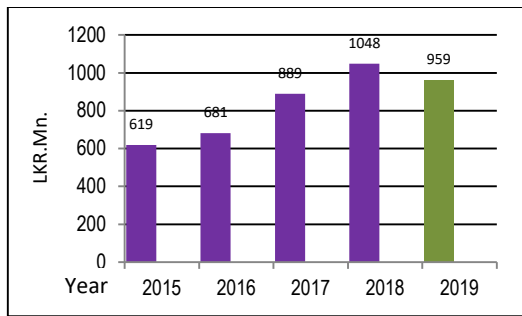
NBRO provided its technical services to stabilize the failed Meethotamulla Waste fill and convert into a recreational park by the Urban Development Authority. Technical advisory was given for the establishment of geotextile layers, leachate extraction piping and gas vents.

NBRO continued the provision of its technical assistance to stabilize failed slopes in Kandy - Mahiyangana road and in other major road networks under Climate Resilience Improvement Program (CRIP) of the World Bank and landslide Disaster Protection Project (LDPP) under JICA assistance.

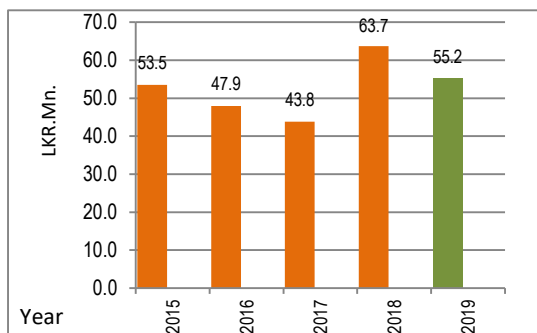
The Government decided to resettle the victims of recent landslide and flood disasters, and also the persons living in areas with high risk in disaster resilient settlements in safer areas. NBRO continued to assist resettlement projects implemented by other agencies and in addition, commenced the implementation of a large resettlement project in Kalutara and Ratnapura districts by NBRO itself.

### **REVENUE**

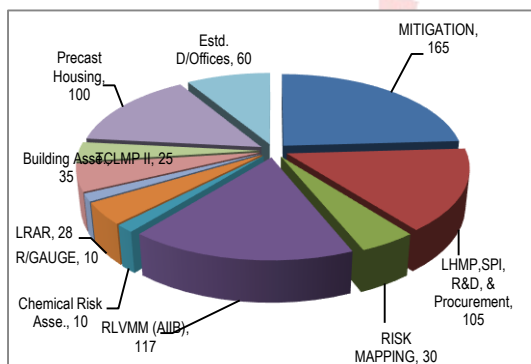
Recurrent expenditure of NBRO is mainly met by the revenue it generates by provision of consultancy & testing services offered to state and private sectors. Other than that, NBRO receives funds for implementing mitigation projects, mapping, special landslide investigations and other govt. funded projects.



Total Operating revenue for last 5 years



Profit &amp; loss record for last 5 years



Govt. Grant for projects – 2019

Since 2010, NBRO has been able to earn a net profit each year.

### CONSTRAINTS

The following are identified as constraints.

- ✚ Draft Bill of NBRO has not been approved yet.
- ✚ Being a government organization, it is difficult for NBRO to be very competitive in bidding for consultancies.
- ✚ Payment to NBRO staffs for extended working hours is rather limited.

### INITIATIVES FOR PRODUCTIVITY IMPROVEMENT

The following actions have been taken to enhance institutional performance in the year 2019.

- ✓ All three laboratories acquired accreditation and maintained
- ✓ NBRO continued to receive donations under technical cooperation projects to enhance technical capacity
- ✓ Design unit of NBRO is contributing to the landslide mitigation projects
- ✓ NBRO built capacity to carry out geotechnical risk assessments for high-rise and large building complexes to ensure the safety and minimum disturbance to surrounding neighborhoods and adjoining properties

### FUTURE PLANS

- Plans have been devised to construct new district offices as these are now in rented buildings
- Plans have been devised to accelerate the preparation of hazard maps and risk profiles
- NBRO will carry out condition assessment of public buildings as a state-funded project
- NBRO will conduct studies on chemical hazard management in Sri Lanka
- NBRO will introduce recently prepared guidelines to construction industry
- NBRO expects to carry out landslide mitigation and related capacity enhancement with JICA assistance through TCLMP – Phase II

### APPRECIATION

I take this opportunity to thank Hon. Chamal Rajapaksa the state minister of Defence and Major General (Retd) Kamal Gunaratna, Secretary of the Ministry of Defence, and Chairperson of Interim Management Committee (IMC) of NBRO whose direction and guidance have paved NBRO the way to this success.

I also wish to thank members of IMC and Audit & Management Committee, the Director Generals of Department of Budget, Department of General Treasury, National Planning Department, External Resources Department (ERD), Disaster Management Centre, Department of Meteorology, Geological Survey & Mines Bureau and Director National Disaster Relief Services Centre (NDRSC) who deserve great appreciation.

At this juncture our gratitude is also extended to our international stakeholders, the World Bank, UNDP, JICA, ADPC, NGI, AIIB, USGS, Bath University and Salford University and the local collaborating institutions and universities for providing technical and financial assistance for various projects and programs. In addition, I express my sincere thanks to our stakeholders and valued customers for their continued confidence on us. I am grateful to the dedicated employees

of NBRO without the help of whom we will not be able to perform so well and achieve the challenging targets set so high for the 2019.

Above of all, superiority of our performance is attributed to this remarkably competent team, their knowledge, skills and professionalism which is the backbone of NBRO.

We will continue working cooperatively to improve the NBRO performance further in the coming years and accomplish the mission and objectives set by our Annual Action Plan. We are sure that our team members will be very supportive of each other and collaborate across teams in sharing ideas and achieving great outcomes.

**Eng. (Dr.) Asiri Karunawardena**  
Director General

## Vision, Mission and Corporate Goals

### VISION

**“Creating a safer built environment”**

### MISSION

**Promote and sustain research and development and provide technical services for disaster risk reduction and safer built environment**

### CORPORATE GOALS

- ✚ To become the national leader in building disaster resilience & DRR Research
- ✚ To become a technically proficient institution
- ✚ To become a leading technical services provider
- ✚ To be a high performer as the national focal point for landslides and associated geo-hazards
- ✚ To continue as a centre for technological information



## Management of NBRO

### MINISTER IN CHARGE OF THE SUBJECT

Hon. Chamal Rajapaksa  
State Minister of Defence

Presently a Cabinet approved Interim Management Committee (IMC) with Secretary of the line ministry as the Chairman guides and directs the administrative, financial and management functions of NBRO.

### INTERIM MANAGEMENT COMMITTEE (IMC)

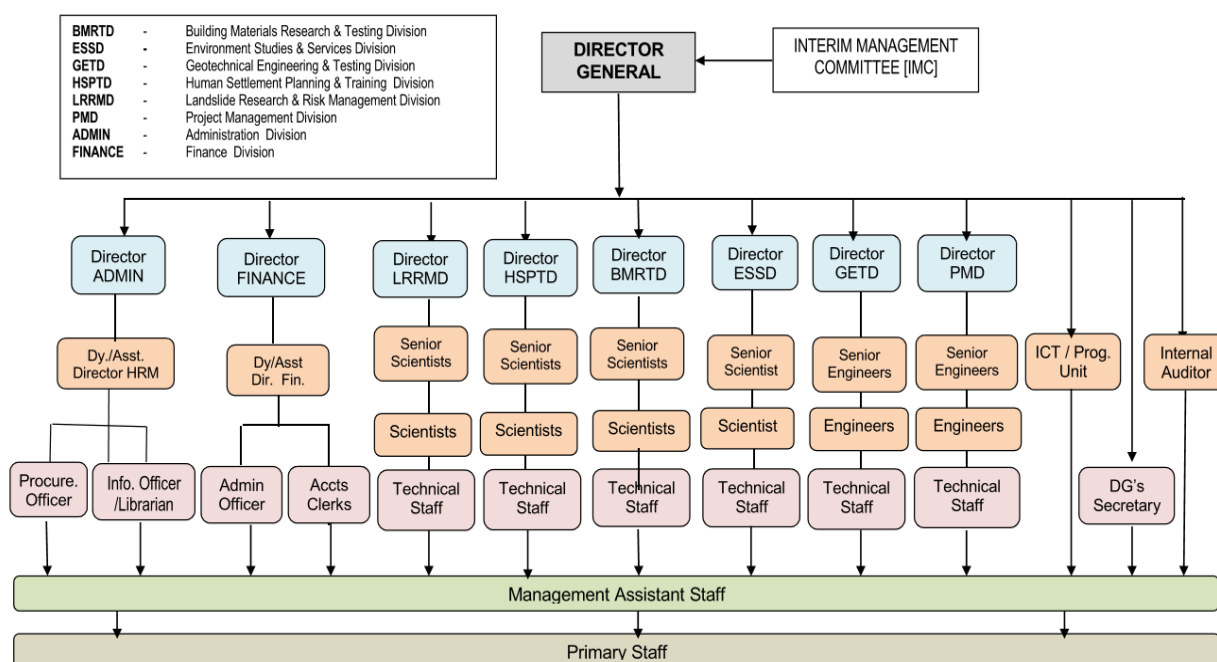
<b>Major Gen. (Retd) Kamal Gunaratna (Chairman)</b> Secretary, Ministry of Disaster Management	<b>Eng. (Dr.) Asiri Karunawardena</b> Director General, National Building Research Organisation
<b>Mr. W A Dharmasiri</b> Director General, Disaster Management Centre	<b>Mrs. Samanthi Meethalawa</b> Asst. Director, Department of National Budget
<b>Eng. C D W Alahakoon</b> Addl. Secretary (Technical), Ministry of Housing and Construction	<b>Mr. H U R Fonseka,</b> Chief Accountant, Ministry of Disaster Management
<b>Mr. A K Karunanayake</b> Director General, Department of Meteorology	<b>Mr. H K Balachandra</b> Director General, Construction Industry Development Authority

### AUDIT & MANAGEMENT COMMITTEE

<b>Mrs. Samanthi Meethalawa</b> Director Department of National Budget	<b>Mrs. R A N D Ranatunge</b> Chief Internal Auditor Ministry of Disaster Management
<b>Mr. H K Balachandra</b> Director General Construction Industry Development Authority	<b>Mrs. A B R Amarakoon</b> Audit Superintendent Government Audit Branch
<b>Eng. (Dr.) Asiri Karunawardena</b> Director General National Building Research Organisation	<b>Mrs. Kumudu Randeny</b> Director (Finance) National Building Research Organisation
<b>Mr. H. L. Ruwanthilaka</b> Internal Auditor National Building Research Organisation	



## Organisation Structure



### SENIOR MANAGEMENT

<b>Eng. (Dr.) Asiri Karunawardena</b>	Director General
<b>Mr. Kishan Sugathapala</b>	Director, Human Settlements Planning & Training Division
<b>Ms. Sardhanee V Dias</b>	Director, Environmental Studies & Services Division
<b>Mr. Kithsiri N Bandara</b>	Director, Geotechnical Engineering & Testing Division
<b>Ms. Sunethra Muthurathna</b>	Director, Building Materials Research & Testing Division
<b>Ms. Kumuduni Jayawardena</b>	Director, Project Management Division
<b>Dr. Gamini Jayatissa</b>	Actg. Director, Landslide Research & Risk Management Division
<b>Mrs. Kumudu Randeny</b>	Director, Finance
<b>Mr. Sarath Cooray</b>	Actg. Director, Administration

## Operational Highlights



In 2019, National Building Research Organisation (NBRO) embarked on a large-scale government funded project for construction of precast houses for resettlement of the disaster displaced families in Kalutara and Rathnapura districts. In addition, the mega scale Reduction of Landslide Vulnerability by Mitigation Measures Project started in 2018 made progress as well. NBRO implemented Nature Based Landslide Risk Management Project with Asian Disaster Preparedness Centre and further developed new collaboration with several international institutions (SATREPS, NILIM, SABO & USGS) in view of strengthening institutional capacity. Landslide Early Warning Centre backed by improved automated rain gauge and ground instrument network continued to function and disseminate early warnings effectively. The NBRO Research Symposium was held for the 10th time in December 2019.

NBRO is the research arm and the only technical agency in the Disaster Management Division of the line ministry. NBRO was able to provide solutions to many issues in the country especially utilizing combined capacities of multi-disciplined technical divisions backed by their modern facilities. NBRO's expertise is now offered as technical services mainly in the fields of geotechnical engineering, building materials technology, human settlements planning, environmental management & project management. NBRO specializes now in emerging fields to address many other issues in the country, especially in landslide mitigation technology, detecting ground subsidence, creating disaster resilience and promoting drought adaptation, which other institutions do not have the technical expertise and equipment capacity.

During the year under review NBRO carried out the following specific tasks in line with its designated functions and Annual Action Plan.

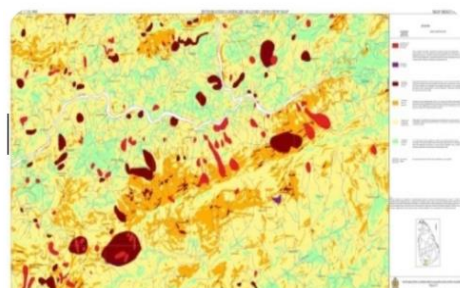
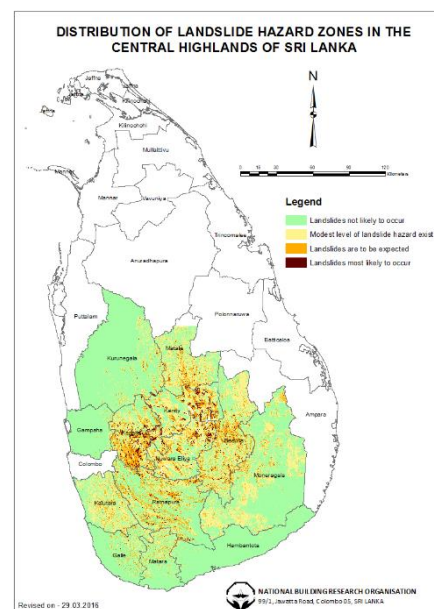
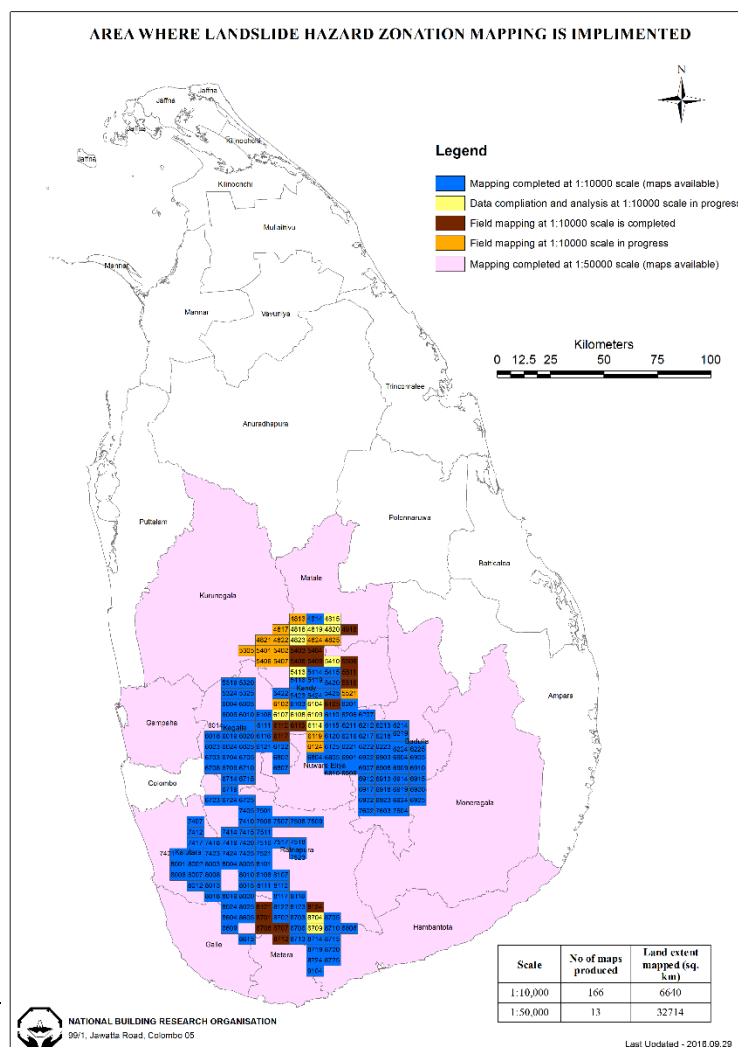
## GOSL Funded Projects

### Landslide Hazard Zonation Mapping Programme (LHMP)

The government assigned NBRO to carry out landslide studies after severe landslides in 1985. Thereafter, NBRO started landslide identification and mapping work and subsequently, the Landslide Hazard Zonation Mapping Project (LHMP) was launched in 1992 with the assistance of the UNDP. Later, the project continued to this date with government funds identifying spatial distribution of landslide hazard and producing landslide hazard maps. Maps to the scale 1:50,000 have been prepared to cover a total of 32,593.1 sq. km in 13 districts identified as having the landslide hazard risk and in addition, maps to the scale 1:10,000 have been prepared to cover prioritized areas covering a total of 7,560 sq. km.

In 2019, the project received a Government grant of Rs. 20.0 Mn. and as the outcome, 9 map sheets each covering 40 sq. km in 1:10,000 scale were prepared in the districts of Matale and Nuwara Eliya. Total area covered under 1:10,000 scale was 360 sq. km.

The maps produced by this project are used in the issuance of landslide early warning, and in landslide investigation work leading to hazard risk assessment, issuance of Landslide Risk Assessment Reports (LRAR), and identification and prioritization of potentially dangerous sites for mitigation. The maps are also used in national and regional level planning by various institutions. Most of these maps are available for downloading free of cost in the NBRO website ([www.nbro.gov.lk](http://www.nbro.gov.lk)).



Hazard Zonation Map 1: 50,000 Scale

### Landslide Risk Assessment Reporting Process (LRAR)

NBRO issues Landslide Risk Assessment Reports to local governmental authorities recommending whether to grant or not approval to a building permit or approval of a development project when sites are in landslide-prone areas. By 31<sup>st</sup> December 2019 the NBRO has received 81,275 applications since the issuance first started in March 2011. The number of applications received in 2019 was 7971; the number of approvals issued was 7601 and the number of applications rejected was 115. The NBRO charges a nominal fee to process an application, carry out necessary investigations and issue a report. The General Treasury provided Rs. 28.0 Mn in the year 2019 to cover the recurrent expenditure of this process and balance expenditure was borne by NBRO revenue as CSR.

Table : LRAR details since the process inception in March 2011

	(district) දිස්ත්‍රික්කය	1	2			3=1-(2a+2b+2c)	Pending Application Details (අනිරික්ෂිත ඉල්ලුම්පත් පිළිබඳ විස්තර)		
		Total Applications Received (ලැබූ ඉල්ලුම්පත් සංඛ්‍යාව)	Total Applications work completed (වැඩ නිමකළ ඉල්ලුම්පත් සංඛ්‍යාව)			Total applications pending (අනිරික්ෂිත ඉල්ලුම්පත් සංඛ්‍යාව)	Pending For initial Investigation (මූලික පරීක්ෂණ සඳහා)	Referred to detailed investigation (විස්තරාත්මක අධ්‍යයනයට යොමු කිරීම සඳහා)	Documents Pending from Client (ඉල්ලුම්කරුගෙන් අදාළ ලියකියවිලි ලැබෙන තෙක්)
			2a Permission granted (අනුමැතිය ලබා දුන් ඉල්ලුම්පත්)	2b Permission not granted (අනුමැතිය ලබා නොදුන් ඉල්ලුම්පත්)	2c Applications rejected due to other reasons (වෙනත් හේතූන් මත අවසරය ලබා නොදුන් ඉල්ලුම්පත්)				
1	Kandy	18656	16750	290	1392	224	27	5	192
2	Matale	7825	7716	16	33	60	46	0	14
3	Nuwaraeliya	6957	6706	48	51	152	38	79	35
4	Badulla	10576	10004	166	310	96	59	28	9
5	Kagalle	10562	10102	40	420	0	0	0	0
6	Rathnapura	9943	8497	36	1336	74	52	2	20
7	Kaluthara	939	905	5	26	3	3	0	0
8	Galle	13666	13615	8	23	20	18	2	0
9	Matara	2082	2070	5	7	0	0	0	0
10	Hambanthota	36	36	0	0	0	0	0	0
11	Kurunagala	20	20	0	0	0	0	0	0
<b>Total</b>		<b>81262</b>	<b>76421</b>	<b>614</b>	<b>3598</b>	<b>629</b>	<b>243</b>	<b>116</b>	<b>270</b>

### Landslide Special Investigations (SPI)

District and Divisional Secretaries, and officials of governmental institutions often request NBRO to conduct landslide special investigations for the purpose of identifying risks in particular sites in relation to the safety of neighbouring human settlements, infrastructure and plantations and to provide immediate recommendations. A total of 3355 landslide special investigations were performed in 2019. The General Treasury has provided Rs. 55.0 Mn. for this work.

### Landslide Mitigation Program (GOSL Funded)

The landslide and slope instabilities needing mitigation have been identified by LHMP and SPI, and eight prioritised sites were mitigated during 2019 as indicated by the following.

No	District	Project/Location	Cost (Rs. Mn.)
01	Kandy	Gadaladeniya Central Collage -Udunuwara	20.9
02	Kandy	Mahawatta Maha Vidyalaya- Kundasale	29.7
03	Matale	Siri Dharmathilaka Vidyalaya -Ukuwela	26.8
04	Badulla	Kahattewela Rahula Vidyalaya -Haputhale	29.7
05	Kandy	Water Treatment Plant, - Gampola Udapalatha	38.6
06	Kandy	Hillwood College, Kandy -Gangawata Korale	9.2
07	Badulla	Access road to Uduhawara Sri Wijayaramaya and Welamadagama -Uwa Paranagama	4.3
08	Badulla	Unstable cut at Kovil Kade road -Passara	0.6

### Development of Risk Profile for landslide prone areas

#### 1: 10,000 Landslide Risk Map

Landslide risk maps show landslide potential together with the expected losses in terms of casualties, if a landslide occurs. Landslide risk maps are developed by combining human settlements maps and landslide hazard zonation maps. These maps will serve as a tool to guide investments in development and utilization of lands susceptible to landslides.

- 2018 - 123 exposure maps were prepared
- 2019 - 04 exposure maps were prepared

#### Database on Elements at Risk

A database is an organized collection of records and can be called as a type of electronic filing system that enables efficient and quick retrieval of data. NBRO created a Database on Elements at Risk where the elements at risk are the population, properties, economic activities, or any other defined values exposed to hazards in a given area. The aim of elements at risk analysis is to assess the characteristics of the inhabitants, characteristics and use of the buildings of the elements at risk of landslides.

- 2019 – 10517 building units were uploaded to database

#### Land Bank Mapping

“Land Bank” concept was initialized as a gap filling activity in utilizing the outcome of a landslide hazard map, a landslide risk map and their application in the decision making in development. The land bank maps facilitate identification of suitable lands available for development and function as tools for decision makers in development planning in Landslide-prone districts.

The Land Bank is a pool of lands that can be allocated for safe development. It will be a base document for development agencies, in rural development activities, resettlement activities, defining mitigation measures and other major land use or development activities.

- 2018 - 1: 10,000 scale land bank maps – 31 completed





Landslide Hazard Map (76/03)

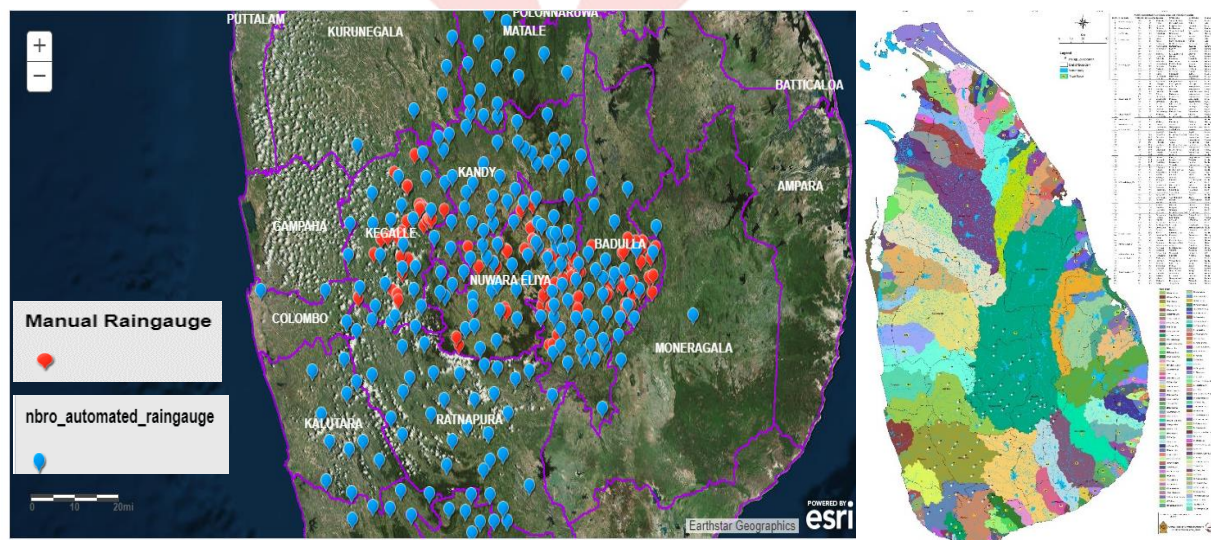


Landslide Risk Map (76/03)

### Enhance real time landslide forecasting & early warning capacity by expanding automated rain gauge network.

A network of automated rain gauges for monitoring rainfall for effective landslide early warning has been developed: Triggering of landslides often occurs due to increase in soil moisture by high intensity rainfall. National Building Research Organisation issues landslide early warning by taking rainfall into consideration from weather forecasts issued by the Department of Meteorology and data acquired from the network of automated rain gauges of NBRO.

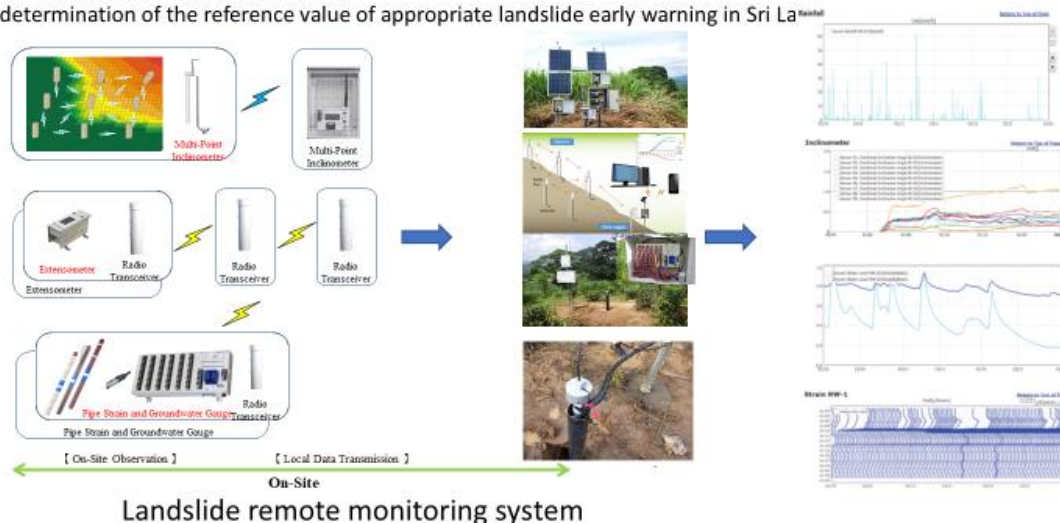
At present, a total of 275 automated rain gauges had been installed and in operation in the network and utilize the real-time data acquired from the network in the landslide early warning process. Landslide Early Warning Centre that functions on 24 hours a day basis during inclement weather, issues landslide early warnings to landslide vulnerable communities through the National Emergency Operation Centre of Disaster Management Center.



Automated &amp; manual rain gauges locations

## IMPROVEMENT OF LANDSLIDE EARLY WARNING SYSTEM – SITE SPECIFIC WARNING

- Development of the Landslide Remote Monitoring System (LRMS) - this is able to transmit on-site monitoring data using a radio communication network.
- Confirmation of landslide deformation based on several monitoring data such as extensometer, rainfall gauge and other instruments.
- determination of the reference value of appropriate landslide early warning in Sri Lanka



## Systematic assessment of chemical disaster risk in Sri Lanka

Occurrence of accidents in chemical using industries is showing an increasing tendency and exposure of vulnerable elements in the neighbourhood to this hazard could lead to man-made disasters. A systematic procedure for risk assessment is absent, and poor transparency on information to the public on overall situation makes the situation worse. Past incidents highlighted the gaps in current DM process and while understanding the potential for chemical disasters, the need has been strongly felt for introducing a chemical hazard mitigation framework and a sound legal framework on management of disasters associated with chemical accidents.

Preparatory work of this research study has been completed already. The risk assessment methodology for chemical using industries is being prepared at present. Database platform is being developed in order to gather chemicals using industrial data for risk and impact assessment. The first volume of safety guidebook for five industrial chemicals was developed and published for the usage of relevant personnel. Furthermore, a stakeholder workshop was successfully conducted in order to identify the related authorities for chemical disaster management. Similarly, six workshops for capacity building workshops were conducted for the competency development of NBRO scientists and stakeholder organisations related to chemical disaster management with the participation of Eng. Tissa A. Dodangoda who is a senior lecturer at University of Moratuwa as a resource person and a consultant for the project.

## Developing a system for building assessment and condition reporting

State owned public buildings and owners of other buildings commonly used by the general public having one or more following factors could be considered for the investigation to obtain a technical assessment report from NBRO and implement technical recommendations contained therein. NBRO carried out structural assessment and investigation of 61 buildings in 2019.

- older than design life
- showing evidence of deterioration due to advanced age
- having inferior structural integrity



- suffered physical damage during a disaster
- because of poor maintenance
- resulted by impact of construction activities in the surroundings

### Construction of Pre-Cast Disaster Resilient Houses for the People Residing in Disaster Prone Areas



Intensity and frequency of the occurrence of natural disasters such as landslides, floods and high winds in Sri Lanka have increased during the past decade due to natural and manmade reasons resulting extensive loss of lives, loss of livelihoods and disruption to economic activities. Relief expenditure after each disaster event is also large. Therefore, the government decided to resettle the people living in disaster prone areas in safer locations. National Building Research Organisation identified about 14,000 such families at the risk of landslides alone. From 2016 onwards, the Ministry of Public Administration, Disaster Management and Livestock Development implements the resettlement of these families with the Owner-Driven Approach. As this approach has been making a slow progress, the government decided to speed up the resettlement programme through the construction of pre-cast resilient houses. Accordingly, the project of “Construction of Pre-Cast Disaster Resilient Houses for the People Residing in Disaster Prone Areas” was launched in September 2019. Initially as the Phase I of the project, 400 precast housing units will be constructed in Kalutara and Rathnapura districts and work in 3 sites namely, Pimburawatta, Mirishena and Halwathura has already commenced.

### Stabilising Meethotamulla waste fill for development

#### CLOSURE AND RECLAMATION OF ABANDONED MEETHOTAMULLA WASTE DUMPING SITE



Abandoned Meethotamulla Waste fill



- National Building Research Organisation (NBRO) is undertaking the design work for the proposed development in Meethotamulla waste fill
- Major concerns in the process of developing a landscaped landfill include slope stability, leachate management, landfill gas management and instrumentation and monitoring
- Consultancy, designs with specifications and construction drawings
- June 2018- December 2020



## Research & Development Program



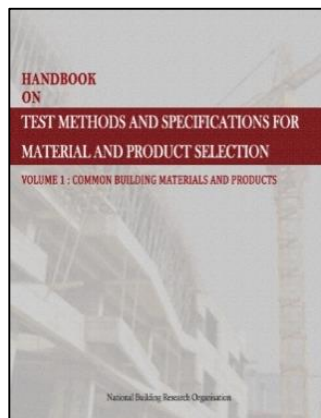
NBRO continued to receive annual government research grant of Rs. 15.0 Mn in 2019. An Industrial Consultation to learn research needs of stakeholder institutions and construction industry was held on 29th January 2019. R & D programme with research projects focused on creating disaster resilience was devised and carried out. Outcomes of research projects were presented and published at the 10<sup>th</sup> Annual Research Symposium of NBRO titled 'Equitable Resilience' held on 17<sup>th</sup> and 18<sup>th</sup> of December 2019 in Colombo. Altogether 48 technical papers were published in the Symposium Proceedings. The well attended symposium provided participants a platform for discussion and sharing experience.

### R & D projects in 2019

#### **Continuation of developing manuals on resilient construction**

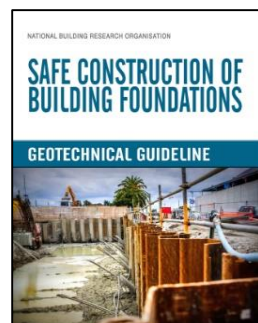
As requested at the Industry Consultation, NBRO formulated research projects to compile several manuals under the R&D Programme. Experts in respective fields assisted in this work and steering committees provided the required guidance. Drafts were first presented to representatives from stakeholder institutions and construction industry, and then, revised as per their advice. The final documents were published in December 2019 in parallel to the Symposium and made available for free downloading at NBRO website: [www.nbro.gov.lk](http://www.nbro.gov.lk).

#### **Development of guideline for selection of materials and products for construction industry**



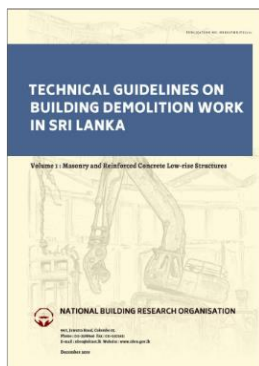
Having realized that, there is no country specific construction material and product selection handbook or a guideline for the construction industry professionals in Sri Lanka to ensure that the most appropriate materials and products are used in civil engineering construction, NBRO took a proactive role and formulated this research project. As the project outcome, 'The Handbook on Test Methods and Specifications for Material and Product Selection - Vol 1: Common Building Materials and Products' was compiled and published. This document is quite comprehensive and details properties, test methods and standards of all most all commonly used construction materials in the country. This document will be very useful in large housing construction projects such as housing projects for resettlement of disaster affected and disaster vulnerable communities. The project will continue for two more years to produce volumes II & III.

#### **Development of geotechnical guidelines for high-rise buildings**



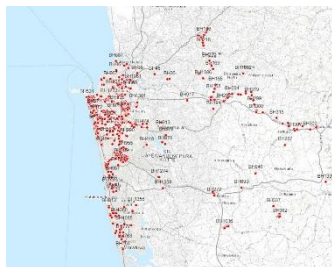
Excavation and other construction activities in high-rise buildings and large building complexes often affect stability of adjacent buildings and sometimes, damage them. As a prevention measure, it is necessary to develop mechanisms to guide design and construction personnel for them to follow proper and systematic work procedures. This research project probed into pros and cons in present design and construction work and prescribed correct procedures to follow and as the project outcome, this guideline 'Geotechnical Guideline on Safe Construction of Building Foundations' was compiled and published.

## Preparation of Technical Guidelines for Building Demolition work in Sri Lanka



Building demolition work in Sri Lanka is carried out often without adhering to proper procedures because of the unavailability of statutory technical guidelines, codes, safety standards or regulations. The lack of involvement of relevant professionals in planning & direction, monitoring & supervision in ensuring safety of life and property are other contributory reasons for recent tragic incidents. Hence, NBRO as a R&D project conducted necessary studies on global and local practices of building demolition and contractor experience, and then compiled this guideline titled 'Technical Guidelines on Building Demolition Work in Sri Lanka' to provide guidance on safe and good practices for demolition works. This guideline elaborates safe practices on demolition of low-rise buildings of masonry & reinforced concrete framed structures with in-filled walls that are recommended to be adopted especially in urban and congested locations of Sri Lanka.

## 3D Subsurface geological geotechnical model for disaster resilience housing of Colombo



In Colombo, many building construction projects are in progress at any given time and at the same time, many new projects are in the planning stage. It is always advantageous to know about subsurface condition of a construction site before commencing any geotechnical investigation and foundation design. NBRO possesses a large database on geotechnical data from investigations carried out in the past. These data were collated and a computer model giving 3D Subsurface Geological Geotechnical Data of Colombo Municipal Council area was prepared by this research project. This model is now made available at the NBRO website for web browsing and it will benefit geotechnical practitioners and constructional professional. More data will be collected and added in future to enrich the model.

## Preparation of building codes for Resilient Sri Lanka



NBRO is assisting Construction Industry Development Authority (CIDA) in the preparation of suitable country specific building code for Sri Lanka. On the recommendation of International Code Council, the CIDA has selected to adopt International Building Code in the Sri Lankan codes development process. In this context, NBRO is developing "Building Code for Disaster Resilience" and it is expected to complete this task in the next 9-12 months period.

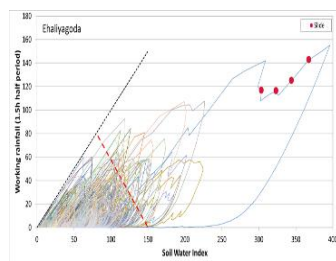
## Designing a transitional shelter for disaster-affected communities



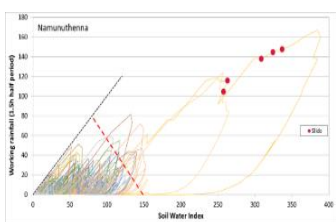
Occurrence of disasters has increased in the recent past due to effects of climate change and expansion of unplanned human settlements. People living in high hazard areas are ordered to evacuate homes at times of a potential disaster and they may have to live in temporary shelters until permanent shelter solutions are made available. Temporary shelters in current practice are school buildings, tents, or other public buildings. In this research project, a transitional shelter that can be assembled quickly and adequate in size for a family to live in for a period of about 1 -2 years was designed. Developed shelter is liveable, low in cost, stable against natural disasters and with minimum impact to the existing environment.



## Determination of thresholds based on rainfall indices for the occurrence of landslides in Kalu Ganga basin, Sri Lanka



This study was carried out to investigate the relationship between date/time of landslides occurred and rainfall indices in Kalutara district. Learning from previous events, it was identified that landslides trigger from either high intensity rainfall with low cumulative rainfall or low intensity rainfall with high cumulative rainfall. Therefore, the study was focused on determination of localized rainfall thresholds by an empirical approach, with the aid of the combination of long term and short-term rainfall indexes. Soil water index (SWI), 72 hours half period working rainfall, 72 hours and 24 hours cumulative rainfall are used as long term rainfall indices while 1.5 hours half period working rainfall and hourly rainfall are used as short term rainfall indices.



The obtained results show more uniform pattern with the combination of SWI and 1.5h half period working rainfall compared to the other indices. The study proved that the use of the combination of SWI and 1.5h half period working rainfall lead to improve the early warning accuracy. Furthermore, it is proved that large scale landslide events have mainly occurred in high SWI, but small scale slope failures have occurred even in low SWI. For the Kaluganga basin area, all the landslides initiated exceeding the value 80 of 1.5 hours half period working rainfall and 140 to 300 SWI values depending on the locality. But it is difficult to set the exact critical values based only on the study. Thus, more research with more landslide and rainfall records is needed to investigate the relationship of rainfall to trigger a landslide event and to improve the current early warning system.

## Hydrological functions of small tank eco systems and its role in sustainable water management



This project aimed at developing an evidence based technical guidelines for small tank rehabilitation. Tank (wewa) is considered to be the most crucial water management unit in the dry zone of Sri Lanka due to its unique capability in sustainable water management. The architecture of ancient tanks includes several hydro ecological zones (HEZ) having unique water conservation functions. Among these functions water holding capacity and the hydrological functionality of HEZs to compensate evaporation losses during dry seasons is considered to be a significant factor in the sustainable water management in the dry zone. This research focuses on studying the aspects of hydro ecological functions of HEZ in selected tanks in Anuradhapura (Kunchikulama and Hiripitiyagama) to establish an evidence basis pertinent to HEZs water retention properties under varying meteorological conditions to be used in developing guidance document for the stakeholder institutions to use in tank construction and rehabilitation works.

### **Sustainable roof-based rainwater harvesting system to overcome domestic water deficit condition in Anuradhapura**



Water stress in an area occurs as a consequence of prolong drought. Attention has now been focused on RWH strategies to address the long-term water stress prevailing in the dry zone of Sri Lanka. However, the latest analysis of the surveys conducted by ESSD on community perception related to Roof RWH shows that it has not yet been popularized among majority of the people.



Realizing the importance of roof RWH as a sustainable solution for the domestic water stress, drawbacks with the existing systems were analysed systematically and design considerations were developed in order to make the systems more user friendly and sustainable.

### **Development of cost-effective green masonry products using textile waste**



Rubber-mixed fabrics like polyester spandex in fabric offcuts from apparel industry is a waste difficult to dispose. This research project developed polyester spandex embedded masonry products with desired strength and other properties needed in construction industry. Paving blocks were developed incorporating shredded form of polyester spandex, which shows superior energy absorption capability. Furthermore, water permeability of this paving block is 100 times higher than that of conventional cement based paving blocks.

### **Development of alternative fibres to asbestos fibres for roofing materials**



This research project investigated the use of natural fibres as viable alternative to asbestos fibres in roofing materials. Natural fibres such as Palmyra and Bristle coir fibre were tested in laboratory in search of their suitability for cement-based roofing sheet. Roofing sheet samples have been fabricated and tested to analyse the mechanical and durability properties.

### **Analysis of waste sludge produced from water treatment plants as a substitute for clay in the manufacturing of clay tiles**



This research investigated the possibility of utilizing the water treatment plant sludge (WTS) as a replacement for conventional tile making clay in manufacturing of clay roofing tiles since a considerable amount of sludge is generated each year by water treatment plants in Sri Lanka. Calicut clay tiles were cast in an industrial clay manufacturing factory and tested in accordance with Sri Lankan standards.

## Suitability of Fly Ash Blended Cements for Construction of Concrete Water Storage Tanks



This research is focused on investigating the leaching of toxic elements from concrete containing fly ash as supplementary cementitious material under two scenarios; (i) the effect of FA content when used as a cement replacement and (ii) the effect of water cement ratio. Cylindrical mortar specimens were cast according to the NEN 7375:2004 sample preparation specifications where the Ordinary Portland Cement (OPC) was replaced by FA in the contents. Finally, the leached constituents were compared with the Sri Lankan Specification for Potable Water.

## Developing a methodology for conducting Social Impact Assessment (SIA) for structural landslide mitigation measures

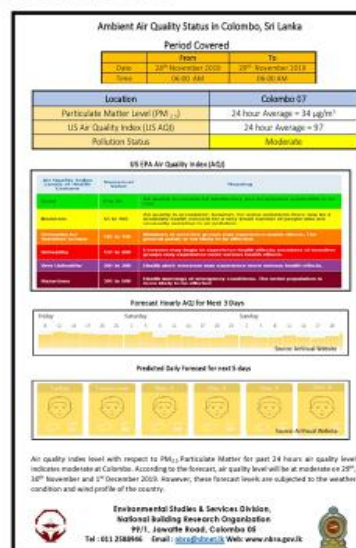
This research project was carried out jointly with consultants from University of Colombo to develop a methodology for conducting social impact assessments when planning and implementing structural mitigation measures in landslide affected areas. A draft methodology was developed and tested in a pilot study conducted in Athwalthota landslide affected area in Kalutara district. A verification study has been planned for the next year as the project continuation.

## Development of real-time air quality monitoring network in urban areas in Sri Lanka for air quality prediction and preparedness system

## AIR QUALITY STUDIES



### Remarkable Increase in Ambient Air Pollution Levels in Colombo, Sri Lanka between 5th & 7th November 2019



NBRO developed sensors for monitoring air quality with the guidance of Dr. Ajith Kaduwela of California Air Resource Board and established a station for real-time monitoring of ambient air quality at the premises of Department of Meteorology in 2018. This work continued in 2019 and with further guidance of Dr. Kaduwela. NBRO verified performance of developed sensors against the Beta Attenuation Monitoring (BAM) and published results at the NBRO Symposium. Now, stations have been established in Colombo, Kurunegala, Vavuniya and Puttalam that give real-time air quality readings to a dedicated website linked to NBRO website.



## Symposia

### NBRO Annual Research Symposium



NBRO presented and published outcomes of 2019 research and collaborative work with local and international stakeholders at the well-attended 10<sup>th</sup> Annual Research Symposium under the theme “Equitable Resilience” in Colombo on 17<sup>th</sup> and 18<sup>th</sup> December 2019.



Chief Guest of the symposium Major General (Retd.) G.D.H. Kamal Gunaratne, Secretary of the Ministry of Defence addressed the gathering at the Inaugural Session and said that, resilience-based sustainable development must be comprehensive in nature, and it requires integrated responses to complex challenges and respect for national ownership and leadership.



Her Excellency Trine Jøranli Eskedal, the Ambassador, Royal Norwegian Embassy in Colombo, the Guest of Honour appreciated the technical cooperation between the Norwegian Geotechnical Institute and the NBRO and highlighted valuable gains made in past 7 years. Ambassador Eskedal emphasised further that there is a clear connection between the need to reduce climate change impacts and prevent climate related and other natural disasters and the need for humanitarian efforts.



Prof. Terence Fernando, Director of the THINKlab School of Science, Engineering & Environment, University of Salford, United Kingdom delivered the keynote address on the first day of the symposium on ‘Technology Enhanced Adaptive Governance to Support Equitable Resilience’.



On the second day, the Chief Guest was Prof. Ranjith Disanayake, Secretary of the State Ministry of Urban Development and in his address, he said that he has a strong working relationship with NBRO in the past and highlighted the contribution of NBRO research to the development of built environment. He emphasised that research agencies could contribute to sustainable development of the country and construction of resilient buildings, and therefore, new tools are needed for achieving sustainability in built environment. He requested NBRO to focus on this matter and mentioned further that the Ministry of Urban Development is expecting to work with NBRO in developing cities in a more sustainable manner.



Dr. Jayalath Edirisinghe, Head of the Dept. of Civil Engineering, UoP in a special address mentioned that UoP has a long history of association with NBRO. He highlighted the usefulness of landslide hazard assessment in the country and mentioned that the output generated by NBRO work has a higher accuracy and the research outcome should be used in development activities.





Mr. Toru KOIKE, Team Leader of Project SABO under NBRO & JICA Technical Collaboration Soft Interventions for Sediment Disaster Risk Reduction, delivered the keynote speech on “Soft Interventions for Sediment Disaster Risk Reduction in Japan” on the second day. He explained the common classification of landslides in Japan and said that, as some mountainous land areas are steep and degrade fast, they cause flash floods and landslides, making buildable land a resource in demand. Hence, the Government of Japan introduced important acts i.e. Erosion Control Act; Landslide Prevention Act, Steep Slope Prevention Act and Yellow Zone Control act to control hazards in highland areas.



### Panel Discussions

The first panel discussion of annual symposium was on “Codes for Resilient Sri Lanka”. Ignite talk to the session was done by Mr. David Walls, Executive Director, and Sustainability Programs, International Code Council. Prof. Priyan Dias, Senior Professor of University of Moratuwa (UoM) was the panel moderator and other panellists were Archt. H. K. Balachandra, Director General, Construction Industry Development Authority (CIDA), Eng. (Dr.) Asiri Karunawardena, Director General, NBRO Dr. Kushan Wijesundara, Senior Lecturer, University of Peradeniya (UoP) and Prof. C. Jayasinghe, Senior Professor, UoM.



The second panel discussion was held on “Equitable Mitigations” with Prof. Bingunath Ingirige, Professor of Urban Resilience and Adaptation, University of Salford as the moderator and Mr. R.M.S. Bandara, Project Director, Project of Reduction of Landslide Vulnerability by Mitigation Measures, Mr. M.F. A. Mubarak, Director, Department National Planning Mr. Suranga Kahandawa, Senior Disaster Risk Management Specialist, The World Bank, Dr. Senro Kuraoka, Chief Engineer, R & D Center, Nippon Koei Construction Co. Ltd Mr. OMURA Tomoki, Vice-Department Manager of Sales & Marketing Department, Tokyo Branch, Nittoc Construction Co. Ltd and Mr. Mahinda Rathnasiri, General Manager, ELS as panellists.



The third panel discussion was held on “Resilient Environment” with Prof. Ajith de Alwis, Chairman, Coordinating Secretariat for Science, Technology and Innovation (COSTi), Sri Lanka as the moderator and Mr. Sarath Premasiri, Senior Scientist, ESSD, NBRO, Dr. S.G.A.T. Siriwardana, Director, Environmental and Occupational Health Directorate, Ministry of Health, Mr. Sugath Dharmakeerthi, Director, Air Resource Management & Ozone Unit, Ministry of Mahaweli Development & Environment, and Dr. A.G.T. Sugathapala, Senior Lecturer, Department of Mechanical Engineering, University of Moratuwa as the panellists.





### Technical paper presentations

Technical papers were presented by respective authors in the four structured technical sessions of the symposium chaired respectively by Dr. U. P. Nawagamuwa, Prof. Terrance Fernando, Prof. S.M.A. Nanayakkara, and Mr. N.M.S.I. Arambepola on the following themes.

- Practicing Resilient Construction
- Data Sharing for Resilience
- Retrofit for Resilience
- Sustainable Resilience

Technical sessions provided an excellent platform to have discussions, exchange ideas and share experience, which made the symposium very successful.

### Launching of NBRO publications and web portals

Altogether 16 presentations were made at the Symposium and 48 technical papers were published in the Symposium Proceedings.

In addition, the following NBRO publications and web portals that are useful to stakeholders, researchers, practitioners and also the general public were launched during this symposium.

- (i) 'MOBILISE Platform' a web-based application to develop a digital infrastructure that can offer intelligence to a range of agencies to work together to reduce the impact of disasters such as floods and landslides on communities – R&D Programme of NBRO with the support of THINKlab School of Science, Engineering & Environment, Salford University.
- (ii) 'Subsurface Geological Geotechnical Model for Disaster Resilient Housing in Colombo Municipal Council' a web portal hosted by NBRO – R&D Programme of NBRO
- (iii) 'Air Quality Monitoring Network' a website hosted by NBRO – RMV and R&D Programme of NBRO
- (iv) "Manual on Nature Based Solutions for Mitigation of Landslide Risk" - Nature Based Landslide Risk Management Project in Sri Lanka by NBRO & ADPC funded by the World Bank
- (v) "Guideline for Management of Chemical Disaster Risk in Industry and facility in Sri Lanka" - Systematic Diagnostic Assessment of Chemical Disaster Risk in Sri Lanka, government-funded project.
- (vi) "The Handbook on Test Methods and Specifications for Material and Product Selection - Vol 1: Common Building Materials and Products" – R&D Programme of NBRO
- (vii) "Geotechnical Guideline on Safe Construction of Building Foundations" – R&D Programme of NBRO
- (viii) "Technical Guidelines on Building Demolition Work in Sri Lanka" – R&D Programme of NBRO



## Training Programmes, Seminars and Workshops

### 1. Training and Awareness Programmes conducted by NBRO for Capacity Building on Disaster Preparedness and Resilience of Hazard Vulnerable Communities in Sri Lanka

NBRO annually conducts training and awareness programmes to various identified communities such as disaster vulnerable communities, persons engaged in construction activities in disaster-prone areas, and officials engaged in disaster mitigation activities to strengthen and enhance their capacities in relevant disaster risk reduction (DRR) activities. NBRO allocated Rs. 3.4 Mn in 2018 and Rs. 5.0 Mn in 2019 respectively for such training and awareness programmes.

In 2019, NBRO conducted awareness programmes for the senior government officers and technical officers in landslide vulnerable districts (3 programmes); awareness creation of masons and beneficiaries of the Resettlement Programme (19 DSD level programmes); awareness programmes for professionals in Plantation Human Development Trust (PHDT) on disaster resilient human settlement planning in estate sector in Sri Lanka; awareness building of school students on proper land-use practices in landslide prone districts, and awareness building among university students on disaster resilient construction methodologies. Further, NBRO promoted disaster resilient housing models in national level exhibitions as well.

NBRO expects extending training and awareness programmes in 2020 as well as promoting provision of recommendations by NBRO for a safer built environment, often in contrary to common practices in land selection, land development and housing construction in Sri Lanka. Being placed under the ministry for disaster management, NBRO is privileged to have been assigned with the responsibility of promoting safety of the housing stock of the country. And, NBRO will endeavour dissemination of technical-know-how among all DRR stakeholder groups in Sri Lanka to make the vision a reality.



Awareness for Government Officials involved on Hazard Resilient Construction



Training for Masons, Involved in Housing Construction on Hazard Resilient Construction



Workshop on Estate-Sector Resettlement Planning for Plantation Human Development Trust (PHDT)



Beneficiary Awareness of National Resettlement Programme



Awareness on Hazard Resilient Construction and Land use Methods for University and School Students



Training for National Disaster Relief Service Officers on Hazard Resilient Settlements Planning

## 2. Training programme on “Upgrading of real time air quality monitoring sensors for application in Sri Lanka”

Dr. Ajith Kaduwela from California Air Resource Board conducted a training program for NBRO staff from 5th November to 21st November 2019 at NBRO on further upgrading of real time air quality monitoring sensor unit. Set of assembled sensor units were tested and data were validated by crosschecking with a high-tech standard method using "Beta Attenuated Technique". It was statistically proven that there were no significant differences between the data obtained by sensor units and data from standard Beta Attenuated Technique for ambient suspended particulate matter monitoring. The results were published and presented at the International symposium organised by NBRO at Colombo, Sri Lanka on 17th & 18th December 2019. During November and December period of 2019, these developed sensor units were used to collect field data in major urban cities; Colombo, Kurunegala, Vavuniya and Puttalam.



## 3. Nature-Based Landslide Risk Management Project

### Workshop 1 (30-31 May 2019)

- Application aspects of Geo-engineering and Bio-engineering methods (and hybrid methods) for mitigation of landslide risk;
- Different methods of improving mechanical and hydrological properties of soil through vegetation;
- Quantitative assessment of impact of bio-engineering applications using a computer model employing limit equilibrium and finite element analysis;
- Practical aspects of analysis of the impact and contributions of vegetation in slope stabilization in a given vulnerable slope;



- Understanding on the approach for site selection, planning and implementation of hybrid (geo-engineering and nature based) solutions for landslide risk management;
- Mechanical consideration of tree root in a slope;
- Contribution of tree root in different compositions of a hill-slope and some idea on modelling root reinforcement in unstable slopes;
- Limitations and challenges in landslide risk management activities including nature-based solutions through case studies from Taiwan.



### Workshop 2 (21 October 2019)

- (i) Review of Guidance Document on use of Nature-based Solutions for Landslide Risk Management
- (ii) Root testing and modeling of effects of vegetation in strengthening sub-soil formations and in improving slope stability



## Major Consultancy Projects

### Clearing geotechnical issues in construction projects

NBRO conducts investigations and issues reports as requested by authorities such as UDA and Tourist Board, prior to them approving projects that involve construction of high-rise buildings and large building complexes where extensive excavation and foundation works are carried out and can impact negatively on neighbouring buildings.

Year	2017	2018	2019
No. Reports & Renewals	32	38	20

### Issuing condition reports on buildings

NBRO conducts investigations to assess the condition of buildings and their structural integrity and then issues relevant reports as a fee-based service. This is done as per a client request or a court order. Often such services are required to assess damage to buildings caused by construction activities in adjacent properties. This process has been carried out for considerably long period by NBRO and the following table gives the details.

Year	2015	2016	2017	2018	2019
No. Reports	42	60	148	116	124

### Study of Ambient Air Quality in Main Urban Cities in Sri Lanka

NBRO continued to study the ambient air quality in main urban cities in Sri Lanka by using passive air quality monitoring technique. Monitoring work of SO<sub>2</sub> and NO<sub>2</sub> was started in 2012 under the VETT program in Colombo, Gampaha, Horana, Rathnapura, Galle and Kalutara. Later, the monitoring was extended to Kandy, Kurunegala, Anuradhapura and Puttalam and PM 2.5 sampling program was also introduced. Collected data are used to enhance the NBRO Air Quality database.

### Major geotechnical consultancy projects



**Extension of Southern Expressway** (Technical Proposal on Embankment Slope Stability at Ch.19+000 km - Client: Road Development Authority)

Extension of Southern Expressway is an ongoing project under the ministry of Higher Education & Highways. A technical proposal on cut slope stability for the cut slopes at Ch. 19+000 was submitted by NBRO. In this regard, importance of identification of unstable soil, rock or local possible failure locations to improve the stability of slopes was highlighted.

## Other Income Generating Activities

NBRO continued the provision of technical testing and consultancy services in the fields of landslide studies and services, geotechnical engineering, project management services, building materials, human settlements planning and environmental management and this work continued to strengthen the financial viability of the institution. Testing and consultancy services provided by NBRO are summarized below:

Activity/ Division	No. of consultancy jobs	No. of testing jobs	Total Income Generated (Rs. Mn.)
Landslide Research & Risk Management Division	7601	-	125.87
Geotechnical Engineering & Testing Division	170	189	235.34
Environment Studies & Services Division	2	622	72.85
Building Materials Research & Testing Division	-	3431	40.65
Project Management Division	124	23	48.63
Human Settlements Planning & Training Division	5	-	42.38
Other Revenue	-	-	53.12
<b>Total</b>			<b>618.84</b>



## Projects with Foreign / Donor Collaboration

### NBRO-JICA technical collaboration projects (Foreign Aid and Technical Cooperation)

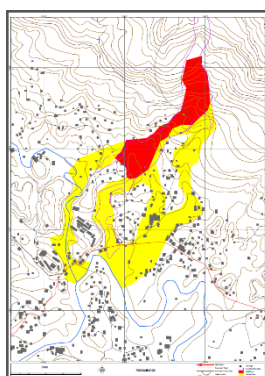
#### ➤ Technical Cooperation for Landslide mitigation Project (TCLMP-Phase I & II)

Mitigation work of 4 hazardous sites (landslide sites in Badulusirigama, Udamadura & Kandy and Alagumale rockfall site), had been completed under Phase – I of the Technical Cooperation for Landslide mitigation Project (TCLMP) with the assistance of JICA. The project works were carried out by NBRO, Koiwa Corporation and Earth System Science Limited with Nippon Koei working as the consultant.

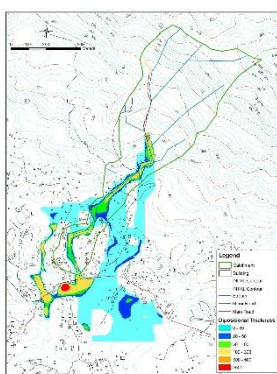
Phase – II of the TCLMP now referred to as Project “SABO” commenced as a three-year project aiming at capacity strengthening on the development of non-structural measures for landslide risk reduction in Sri Lanka with especial emphasis on conducting site specific hazard mapping and risk assessments, issuing landslide early warning at local level, improving existing observation system and alerts, and applying risk assessments of sediment disasters to land-use planning and development standards. At the beginning, three pilot sites from Kegalle, Badulla and Matara were selected for project implementation. In order to achieve the targeted outputs of the project, the following three working groups have been appointed.

Working group 1 (WG1)	- Hazard Analysis and Risk Assessment
Working group 2 (WG2)	- Sediment Disaster Early Warning System
Working group 3 (WG3)	- Land Use Planning and Development Standards

Under WG1, the following works were carried out: review of the existing methodology on Landslide Hazard Zonation Mapping and Risk assessment; improving system for managing landslide disaster records; collecting and analyzing records of past landslide disasters; preparation of draft manuals on site specific hazard mapping and risk assessment; preparation of site specific hazard maps for the three pilot sites using Red zone and Yellow Zone concept; conducting landslide flow path simulation using Hyper KANAKO model for three pilot sites, and conducting site-specific hazard mapping in areas other than pilot sites. In addition, workshops, training and mini-seminars were conducted for the NBRO staff.



Site specific Hazard Map, Morawakkanda pilot site



Output of the flow path simulation, Morawakkanda pilot



Workshop on Site Specific Hazard Mapping



Field survey conducted to verify the prepared Site Specific Hazard Maps

➤ **Verification Survey with the Private Sector for Disseminating Japanese Technologies of the Landslide Remote Monitoring System - 2017**

This project has been implemented subsequent to completion of the project on Instrumentation and Development of Early Warning Systems at Potential Landslide Sites and Development of Capacity to Manufacture Necessary Instruments – 2015. There are identified landslides moving slowly and continuously and it is necessary to monitor these landslides using appropriated ground movement detection instruments. In addition, there are identified communities living in isolation in landslide-prone areas and it is difficult to contact them for landslide early warning dissemination from Colombo. Consequently, above project was implemented to establish landslide remote monitoring systems (LRMS) in pilot sites and connect them to NBRO Landslide Early Warning Centre and establish community early warning systems where necessary. With the assistance from the Government of Japan and the JICA, Earth System Science Limited & Osasi Technos Limited jointly with NBRO implement this project. Instrumentation systems were installed first in Diyanilla in Ratnapura district and in Galaboda in Nuwara Eliya district in 2015 to demonstrate system capability and these two systems are now in operation. Later, instrumentation systems using inclinometers, extensometers, dip meters, ground moisture sensors, rain gauges and signal transmission equipment were installed at several selected landslide high hazard locations. This project is beneficial to respective neighbouring communities.



➤ **Development and deployment of structural and non-structural measures for effective mitigation of landslides and associated hazards and related capacity strengthening - 2019**

NBRO and National Institute for Land and Infrastructure Management (NILIM) of Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Tsukuba City, Ibaraki, Japan jointly implement this project. Teams from NILIM visited NBRO & landslide sites, and held discussions on conducting research on landslides. NBRO scientists had been trained on sediment disaster at the NILIM.

➤ **Development of early warning technology of rain-induced rapid and long-travel landslides in Sri Lanka - 2019 SATREPS (JICA)**

The International Landslide Consortium (ICL) based in Kyoto University in Japan, the leading authority for landslide studies in the world and NBRO jointly applied to Science and Technology Research Partnership for Sustainable Development (SATREPS) of Japan Science and Technology Agency (JST), Department of International Affairs, the Government of Japan and to National Planning Department of Sri Lanka simultaneously for the approval of the project titled "Disaster risk reduction of rain-induced rapid and long-travelling landslides". This five-year Japan-Sri Lanka joint project has been approved for implementation in 2019-2023 period. This proposal proposes introducing advanced technology through the global partners of ISDR-ICL Sendai Partnerships 2015-2025, to disaster risk reduction of rain-induced rapid and long-travelling landslides. Several local and Japanese collaborating and support agencies participate in this project work and initial works have been already started. The expected outcomes are:

1. Technology of 24 hours in-advance prediction of heavy rainfalls and resulting ground water pressure build-ups is developed. A technology to identify locations of rain-induced rapid long-travelling landslides and their moving areas is developed.
2. Technology and framework for effective risk communication to community people living in mountains and local cities are developed.
3. A system for early warning of rain-induced rapid long-travelling landslides is developed by integrating the technologies mentioned above based on the joint research in the pilot study sites. The developed system with guidelines and manuals is provided for the use in other areas in Sri Lanka.
4. The above technologies that are developed will ensure the safety of the public and secure vulnerable communities from landslides and associated hazards.

➤ **Creating Disaster Resilience by the Assessment of Building Deterioration and Prolongation of Service Life**

NBRO together with M/s JRC Services (JICA) has developed this project proposal and the National Planning Department has given the approval. Applications will be submitted to the JICA by M/s JRC Services.

**NBRO –NGI Technical Cooperation Project**

Since 2013, NBRO and Norwegian Geotechnical Institute (NGI) have joined to conduct studies on ground subsidence and landslide studies. The agreement signed then on technical cooperation was extended later to continue the project "Institutional Cooperation on Mitigation of Natural Disasters due to Climate Change" for the five years from 2018 to 2022.

Over the years, the NGI strengthened technical capacity of NBRO by training staff locally and at the NGI. Every year NGI experts visit and together with NBRO staff, conduct advanced surveys. NBRO staff has been trained in GPR techniques and satellite image processing related to landslide and ground subsidence studies. In addition, NGI donated various equipment including an advanced ground penetrating radar system for subsurface mapping, various antennae for horizontal ground scanning and vertical borehole scanning, automated rain gauges, camera drones for aerial mapping and fast computers with dedicated software for image processing.

Royal Norwegian Embassy (RNE) in Colombo provided financial assistance to this project.



## Nature Based Landslide Risk Management Project



NBRO together with Asian Disaster Preparedness Centre, Thailand implemented this project funded by the World Bank and as a project output produced “Guidance Document on the use of Nature-Based Solutions for Landslide Risk Reduction”. This document provides the necessary know-how, understanding and technical guidance on application of nature-based solutions as one of the reliable, sustainable, cost effective landslide risk management option, to personnel involved in designing landslide risk mitigation measures.

## Reduction of Landslide Vulnerability by Mitigation Measures Project

NBRO commenced the Reduction of Landslide Vulnerability by Mitigation Measures Project (RLVMMP) originated from Cabinet approved Integrated Landslide Mitigation Programme. This mega project includes mitigation of identified high risk landslides sites and also, roadside unstable slopes and unstable slopes along the railway lines in the hill country over a 3-year period. The main components of this project are:

- Civil work and associated design and construction supervision / management activities
- Policy and Regulation Enhancement
- Institutional Capacity Building
- Technical Support and Project Management

About 147 sites requiring immediate mitigation had been prioritized by NBRO jointly with local authorities, Road Development Authority and Sri Lanka Railway. As urgent work, related environmental and social impact assessments and geotechnical designs were completed as Phase I of the project for 27 critical sites in 2018.

In 2019, the Project management Unit was established and the key staff was appointed. As activities of the Component (1) of the project, the consultants for the Phase I were selected and tender documentation of Phase I was finalized. Under Phase II, NBRO started field surveys, detailed investigations and design works related other 120 sites in altogether 8 districts and most documents have been prepared for tendering. As activities of Component (2), document preparation work started and as activities of Component (3): Institutional Capacity Building, NBRO received some equipment.

## Developing of sensors for air quality monitoring and soil moisture measurement

In 2018, the staff of Environmental Studies and Services Division guided by Dr. Ajith Kaduwela, an expert from California Air Quality Research Board developed a real-time Particulate Matter Monitoring sampler to measure ambient air quality. In 2019, Dr. Kaduwela further trained staff of ESSD by conducting a series of lectures and practical sessions for NBRO staff. This sensor after being tested and validated, has been deployed for monitoring of ambient air quality in several populated cities in the country. The real time data received are used to show ambient air quality in these cities in a dedicated website linked to NBRO website. The division also developed sensors and data acquisition systems for monitoring soil moisture on the banks of water tanks.



Development of air quality and soil moisture sensors

### Technical Cooperation Project with USGS

A team from United States Geological Survey (USGS) visited NBRO in 2019 and discussions were held to assist NBRO on landslide risk management. A memorandum of understanding was signed between NBRO and the USGS to this effect. The team conducted a training programme for NBRO staff.

### Development of multipurpose geopolymer precast units from industrial waste

NBRO together with Sona college of Technology, Salem, India submitted the above research project proposal to Government of India under Indo-Sri Lanka Joint Research Programme.

## NBRO Publications

### Monographs

1. "Manual on Nature Based Solutions for Mitigation of Landslide Risk" - Nature Based Landslide Risk Management Project in Sri Lanka by NBRO & ADPC funded by the World Bank
2. "Guideline for Management of Chemical Disaster Risk in Industry and facility in Sri Lanka" - Systematic Diagnostic Assessment of Chemical Disaster Risk in Sri Lanka, government-funded project.
3. "The Handbook on Test Methods and Specifications for Material and Product Selection - Vol 1: Common Building Materials and Products" – R&D Programme of NBRO
4. "Geotechnical Guideline on Safe Construction of Building Foundations" – R&D Programme of NBRO
5. "Technical Guidelines on Building Demolition Work in Sri Lanka" – R&D Programme of NBRO

### Newsletters

1. NBRO Newsletter Vol 43 / May 2019 "Envisioning Resilience"
2. NBRO Newsletter Vol 44 / Sep 2019 "Building Buildings"
3. NBRO Newsletter Vol 45 / Dec 2019 "Symposium Edition"

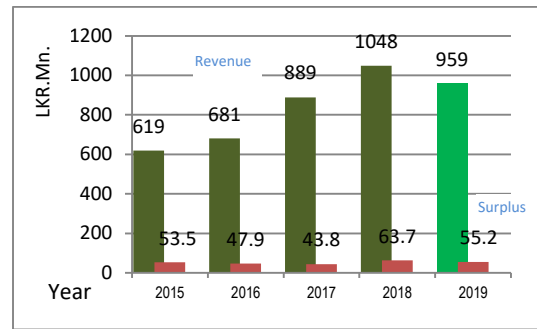
### Web applications

1. 'MOBILISE Platform' a web-based application to develop a digital infrastructure that can offer intelligence to a range of agencies to work together to reduce the impact of disasters such as floods and landslides on communities – R&D Programme of NBRO with the support of THINKlab School of Science, Engineering & Environment, Salford University
2. 'Subsurface Geological Geotechnical Model for Disaster Resilient Housing in Colombo Municipal Council' a web portal hosted by NBRO – R&D Programme of NBRO
3. 'Air Quality Monitoring Network' a website hosted by NBRO – RMV and R&D Programme of NBRO

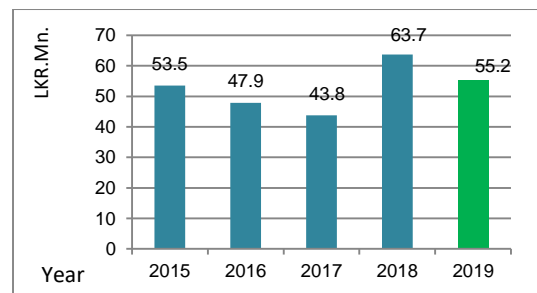
## Financial Highlights

In 2019, NBRO recorded consolidated revenue of Rs. 959.0 Mn. Revenue from customary NBRO services Rs. 618.8 Mn. in 2019. The institution depends mostly on this consultancy revenue generated to meet its recurrent expenditure.

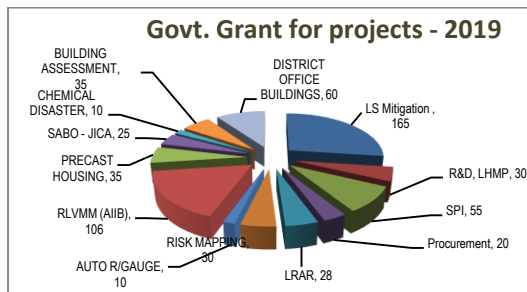
Rs. 578.0 Mn. has been received under government grant for mitigation of high-risk landslides in 2019. Nine district offices of NBRO have been functioning since March 2011 for issuance of Landslide Risk Assessment Reports for development work in landslide-prone districts. Rs. 28.0 Mn. was provided by the Treasury as recurrent expenditure and the balance requirement was met with nominal fee charged from applicants and rest by NBRO revenue.



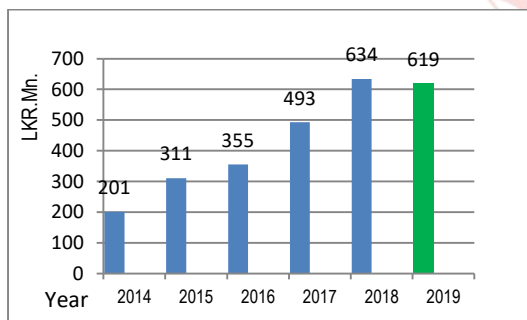
Total Operating Revenue vs net surplus



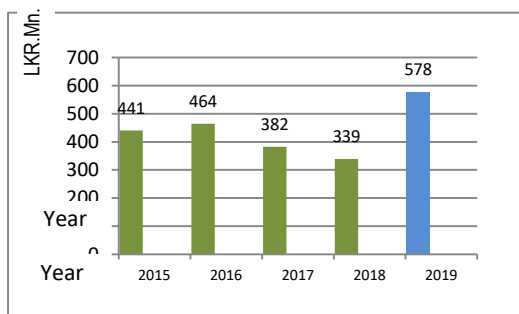
Net profit earning during 2015 - 2019



Government Grant for projects- 2019



Income by Testing and Consultancy



In addition, Research Grant for Landslide Hazard Mapping of Rs. 20 Mn. together with Rs. 15.0 Mn for the Research & Development was received. Grant for Landslide Special Investigations of Rs. 20.0 was received including Rs. 35.0 Mn. for the additional investigation due to extreme climatic events happened in 2019. Procurement Grant for lab & field, office equipment of Rs. 20.0 Mn. was received from the Treasury.

The consolidated revenue for year 2019 was Rs. 959.0 Mn. while total consolidated expenditure for the corresponding period was Rs. 903.8 Mn. A net profit of Rs. 55.2 Mn. was recorded.

The expenses on personal emoluments for the staff strength of 490 plus daily paid employees was Rs. 539.0 Mn. in 2019 as against the staff strength of 483 plus daily paid employees was Rs. 465.9 Mn. In year 2018.

The institution growth and enhanced performance have been mainly due to the courageous effort of the management and the staff of NBRO.

## Statement of Financial Position

### STATEMENT OF FINANCIAL POSITION AS AT 31<sup>ST</sup> DECEMBER 2019

				Rs.
		Annex No	As at 31.12.2019	As at 31.12.2018
<b>Current Assets</b>				
Cash and cash equivalents		1	116,777,209	40,116,143
<b>Receivables</b>	Project Debtors	2	477,982	477,982
	Sundry Receivables	3	75,302,188	48,690,522
			192,557,379	89,284,647
Inventories		4	3,965,848	3,743,181
Pre-payments		5	276,534,857	220,743,686
<b>Other Current Assets</b>				
Project work in progress		6	292,179,615	441,668,072
Others		7	463,912,823	587,593,088
			756,092,438	
<b>Non - Current Assets</b>				
Infrastructure, Plant & Equipment		8	670,221,382	1,343,032,674
New Lab Building WIP			333,811,858	597,301,323
Ratnapura Building WIP			1,310,000	206,249,677
<b>Total Assets</b>			<b>2,234,493,762</b>	<b>2,146,583,674</b>
<b>LIABILITIES</b>				
<b>Current Liabilities</b>				
<b>Payables</b>	Money Received from Clients	9	514,260,662	573,905,412
	Sundry payables	10	139,177,262	142,911,000
<b>Non – Current Liabilities</b>				
<b>Long term provisions</b>				
Provision for Depreciation		11	484,490,237	424,538,506
Provision for Gratuity & Bad debtors		12	93,534,997	75,823,532
<b>Total Liabilities</b>			<b>1,231,463,158</b>	<b>1,217,178,451</b>
<b>Net Assets</b>			<b>1,003,030,604</b>	<b>929,405,223</b>
<b>NET ASSETS / EQUITY</b>				
Capital contributed by Government & Other entities		13	599,526,190	581,140,713
Reserves – Revaluation Surplus			27,875,989	27,875,989
Assets acquired			2,264,498	2,264,498
Accumulated Surplus/ (Deficit)				
Surplus brought forward		14	318,124,023	254,438,619
<b>Surplus for the year</b>			55,239,903	63,685,404
<b>Net Assets / Equity</b>			<b>1,003,030,604</b>	<b>929,405,223</b>



## Statement of Financial Performance

### STATEMENT OF FINANCIAL PERFORMANCE FOR THE YEAR ENDED 31.12.2019

Rs.

Revenue	Annexure	Year 2019	Year 2018
<b>Revenue</b>			
Environmental Studies & Services Division	15	72,854,502	73,217,949
Geo Technical Engineering & Testing Division	16	235,338,251	201,201,699
Landslide Research & Risk Management Division	17	273,147,266	389,967,734
Human Settlement Planning & Testing Division	18	97,376,186	120,654,134
Building Material Division	19	40,648,623	44,577,204
Project Management Division	20	186,387,791	155,569,925
<b>Total Operating Revenue</b>		<b>905,752,619</b>	<b>985,188,644</b>
<u>Other Income</u>	21	53,120,424	63,070,505
<b>Total Revenue</b>		<b>958,873,043</b>	<b>1,048,259,150</b>
<b>LESS - Expenses</b>			
Salaries, Wages and Employee Benefits	22	538,893,390	465,874,891
Supplies and consumables used	23	326,542,078	479,830,392
Depreciation	24	9,244,961	11,192,661
Impairment of Property, plant and Equipment	25	16,333,344	15,747,918
Other Expenses	26	12,565,069	9,301,672
Finance Cost	27	54,298	126,212
<b>Total Expenses</b>		<b>903,633,140</b>	<b>982,073,746</b>
<b>Net Profit before Tax</b>		55,239,903	66,185,404
<b>Income Tax</b>			2,500,000
<b>Net Profit after Tax</b>		<b>55,239,903</b>	<b>63,685,404</b>

## Cash Flow Statement

### CASH FLOW STATEMENT FOR THE YEAR ENDED 31.12.2019

Rs.

	2019	2018
<b>Surplus / (Deficit) before Taxation</b>	<b>55,239,903</b>	<b>63,685,404</b>
<b>Adjustments</b>		
Depreciation	9,244,961	11,192,661
Provision for Gratuity	19,906,232	8,329,841
Gratuity Payment	-2,194,769	-2,689,899
Disposal of vehicles	-	0
unrealized Interest Income	-47,177,596	-58,586,910
Correction for year 2016	-	0
<b>Operating Surplus(Deficit)before working capital changes</b>	<b>35,018,731</b>	<b>21,931,097</b>
<b>Changes in working capital</b>		
Increase in Debtors	-26,611,666	1,188,995
Increase in Pre payments	-55,791,171	-51,227,325
Increase in Inventories	-222,667	-379,359
Increase in Working In Progress	149,488,457	-5,960,012
Increase in Deposits	123,680,265	-457,498,895
Money Received from Client	-59,644,750	-114,535,887
Increase in Sundry Creditors	-3,733,738	16,464,467
<b>Net Cash flows from Operating Activities</b>	<b>162,183,461</b>	<b>-590,016,919</b>
<b>Cash flows from Investing Activities</b>		
Interest Income	47,177,595	58,586,910
Purchase of Fixed Assets	-204,792,239	-159,557,927
Disposal of Fixed Assets	1,500,000	-
<b>Net cash flow from Investment activities</b>	<b>-156,114,644</b>	<b>-100,971,017</b>
<b>Cash flows from Financing Activities</b>		
Government Grant (Procurement)	21,013,401	25,000,000
Other Grants	49,578,848	128,874,229
<b>Cash flows from Financing Activities</b>	<b>70,592,249</b>	<b>153,874,229</b>
Net change in Cash and Cash equivalents	76,661,066	-537,113,707
Cash and cash equivalents beginning of the period	40,116,143	577,229,851
<b>Cash and cash equivalents as at 31.12.2019</b>	<b>116,777,209</b>	<b>40,116,143</b>
<b>Note- Cash and Cash equivalents</b>		
Cash at Bank and hand	116,777,209	40,116,143
	<b>116,777,209</b>	<b>40,116,143</b>

## Notes to Accounts

### 1. Accounting Policies.

Financial Statements have been prepared by Complying with generally accepted Accounting Principles, Fundamental assumptions, Public Sector Accounting Standards and Accounting Standards introduced by the Institute of Chartered Accountants from time to time and also by considering the followings.

- (a) Going Concern
- (b) Consistently Application of Accounting Policies.
- (c) Revenue and expenses recognition on accrual basis.
- (d) Disclosure to deviations to Standards

### 2. General Accounting Policies.

#### 2.1 Depreciation Policies.

- (a) Depreciation is provided based on number of days used
- (b) Fixed assets are depreciated on Straight Line basis using the following rates.

Fixed asset type	%
Buildings	2.5
Machinery and Lab Equipment	20
Furniture & Fitting	10
Vehicles	20
General Office Equipment	20
Drawing Office Equipment	10
Tools	50
Library Books	5
Fire Extinguishers	10

- (c) Amortization for granted assets has been deducted from the carrying value of grants as stipulated in Sri Lanka Accounting Standards.

#### 2.2 Valuation of Closing Stock

Unutilized materials stocks have been valued at cost.

#### 2.3 Provision for Gratuity

Provision for gratuity is calculated in accordance with the Gratuity Act.

#### 2.4 Provision for doubtful Debtors

A provision has been made for doubtful debts on the basis of;

- (a) 1 % Provision for debts outstanding over 2-10 years.
- (b) 25 % Provision for debts outstanding over 10 years.

## Statement of Responsibility for Financial Statements in terms of Sec. 7A.

The Accounting policies & Notes to Accounts on pages 06 form an integral part of these Financial Statements. The Board of Directors is responsible for the preparation and presentation of these Financial Statements. These Financial Statements were approved by the Board of Directors and signed on their behalf.

### Member of the Interim Management Committee of NBRO



Kamal Gunaratne WWV RWP RSP USP ndc psc

Major General (Retd)

Secretary

Ministry of Defence

Chairman of the IMC

Major General (Rtd) Kamal Gunaratne  
WWV RWP RSP USP ndc psc MPhil  
Secretary  
Ministry of Defence



H. U. R. Fonseka

Chief Accountant

Disaster Management Division

Ministry of Defence

H. U. R. Fonseka  
Chief Accountant  
Ministry of Defence  
Disaster Management Division  
Vidya Mawatha, Colombo 07.

### Chief Executive Officer of NBRO



Eng.(Dr.) Asiri Karunawardena

Director General

National Building Research Organisation

Director General  
National Building Research Organisation  
No. 99/1, Jawatta Road  
Colombo 05

### Chief Financial Officer of NBRO



K.K.H. Randeny

Director (Finance)

National Building Research Organisation

K.K.H. RANDENY  
DIRECTOR FINANCE  
NATIONAL BUILDING RESEARCH ORGANIZATION  
FINANCE DIVISION  
99/1, JAWATTA ROAD,  
COLOMBO - 05.

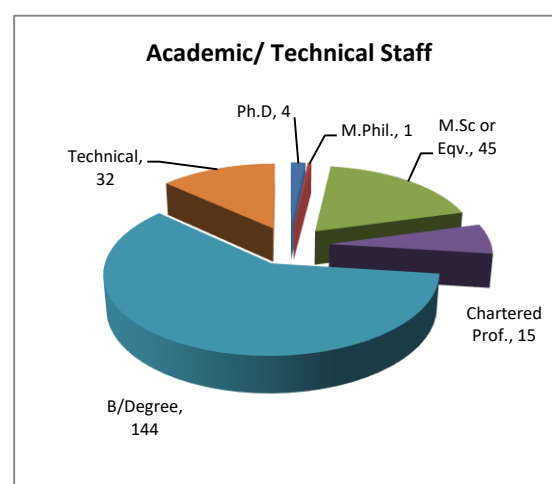
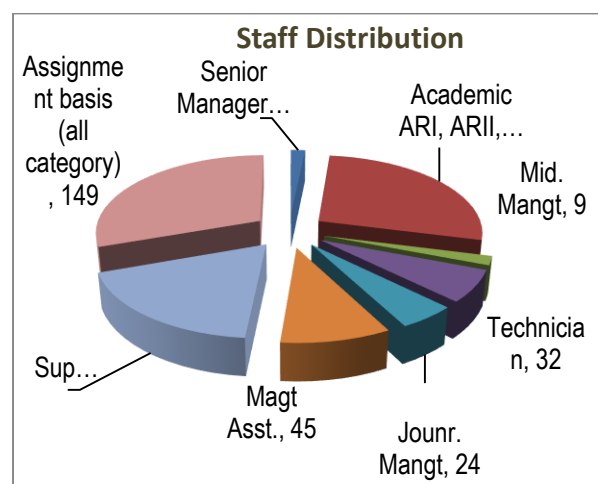


## Human Resource /Capacity Development

NBRO's Vision and Mission were set to develop its capacity to cater the Ministry's DRR needs. With this in view NBRO is in the process of legalizing the institution mission by an act and developing staff capacities to deliver high standard outputs. Human resource and infrastructure needs of the institution are becoming a matter of serious concern with the increasing responsibilities the institution shoulder at present.

Recruitment of new employees for essential vacant positions was done. In 2019, 18 employees in 6 categories were recruited. A staff development program has been launched and opportunities for local and foreign training were increased for NBRO staff to learn and gain experience.

No	Salary / Code	Staff Category	Approved Cadre	Staff Available (Permanent)	No of Vacancies (Permanent)	Additional Staff Available (Other Basis)
1	HM 2- 3	Senior Manager ( CEO)	1	1	0	0
2	HM 1-3	Senior Manager	8	7	1	0
3	AR2	Senior Academic/ Scientist	25	21	4	0
4	MM 1-1	Middle Management	12	9	3	1
5	AR 1	Academic/ Scientist	124	113	11	44
6	JM 1-1	Junior Management	25	24	1	20
7	MA 2-2	Management Assistant (Tech)	36	32	4	15
8	MA 1-2	Management Assistant (Non Tech)	53	45	8	24
9	PL 1,2&3	Primary	102	89	13	45
	<b>TOTAL</b>		<b>386</b>	<b>341</b>	<b>45</b>	<b>149</b>



**RECRUITMENT, RETIREMENTS & RESIGNATION of PERMENANT STAFF IN 2016**

No	Sal/ Code	Staff Category	No of Recruitment	No of Resignations	No. of Retirement
1	HM 1- 3	Senior Manager ( CEO)	-	-	-
2	HM 1-1	Senior Manager	-	-	-
3	MM 1-1/JM 1-1	Middle/ Junior Management	6	-	-
4	AR2	Senior Academic/ Scientist	-	-	-
5	AR 1	Academic/ Scientist	10	4	-
6	MA 2-2	Management Assistant (Tech)	1	2	-
7	MA 1-2	Management Assistant (Non Tech)	-	-	2
8	PL 1,2&3	Primary	1	1	-
	<b>TOTAL</b>		<b>18</b>	<b>7</b>	<b>2</b>

**NBRO Training/Attending Workshop/Seminar etc.**

NBRO carried out various training programmes for its staff. Many staff members were sent for short term training programmes, workshops and seminars abroad. Some scientists were selected for masters programmes abroad.

**Foreign Training Opportunities in 2019**

No	Participants	Designation	Division	Training Information	Period	Country
1	Mr.S.O.A.D.M.Lakruwan	Scientist	LRRMD	JICA Long term training program for Disaster Risk Reduction (DRR) to Implement the Sendai Framework (FY2019)	27.09.2019 05.10.2022	Japan
2	Mr.P.H.C.S.Rathnasiri	Senior Scientist	HSPTD	Urban & Reginal Development Post - Master Retraining Program	19.01.2019 - 02.02.2019	Seoul, Korea
3	Dr. P.Jayasinghe	Senior Scientist	LRRMD	IORA Cluster Group on Disaster Risk Management (DRM)	05.02.2019 - 06.02.2019	New Delhi, India
4	Dr. P.Jayasinghe L.U.M.Kankanmge	Senior Scientist Scientist (Eng.)	LRRMD GETD	Knowledge Sharing Workshop & Stud	06.02.2019 - 11.02.2019	Thailand
5	Mr. W.K.S.M.Wakwella	Scientist (Geologist)	LRRMD	Rapid Assessment for Resilient Recovery (RARR)	29.01.2019 - 01.02.2019	Gujarat, India
6	Mr. C.S.Menikpura	Senior Scientist	LRRMD	Knowledge Co- creation Program Disaster Risk Reduction & Management (Singapore & Japan)	03.03.2019 - 09.03.2019 in singapore 09.03.2019 - 16.03.2019 in japan	Singapore & Japan
7	Eng.(Dr) Asiri Karunawardena Mr. R.M.S. Bandara	Director General Director	LRRMD AIIB	Reduction of Landslid Vulnerability by Mitigation Measures Project - Loan Negotiation	21.02.2019 - 22.02.22	China
8	Eng.(Dr) Asiri Karunawardena Mr. R.M.S. Bandara	Director General Director	LRRMD AIIB	Third South Asia Regional South - learning workshop on " Strengthening Geohazard Risk Management in Transport"	29.04.2019 - 02.05.2019	New Zealand
9	Mr. N.KW.A.M.M.K.N. Bandara Mr. R.M.B. Somarathna	Director General Sr.Scientist	GETD LRRMD	Japan under JICA preparatory survey on Landslide Disaster Protection of the National Road Network Phase - 2	07.05.2019 - 14.05.2019	Japan
10	Dr. H.A.G.Jayathissa Mr.H.M.L. Indrathilaka , Mr.S.M.S. Aroos, Mr.E.I.Jayasekara	Act. Director Scientist	LRRMD	7th International Conference on " Debris Flow Hazard Mitigation	08/06/2019 - 18/06/2019	USA

10	Dr. H.A.G.Jayathissa Mr.H.M.L. Indrathilaka , Mr.S.M.S. Aroos, Mr.E.I.Jayasekara	Act. Director Scientist	LRRMD	7th International Conference on " Debris Flow Hazard Mitigation	08/06/2019 - 18/06/2019	USA
11	Mrs. H.D. Kumarapeli	Scientist	ESSD	Training program for Researchers on 'Asbestos Fiber Determination in Russian Research Institute of Mineral Raw Materials"	27/05/2019 - 01/07/2019	Russia
12	Mrs. G.D.W.N.Galhena	Scientist (Eng.)	GETD	Training program on " Disaster Management for Sediment related Disasters (Landslide, Debris flow, Flash Flood & Volcanic Mudflow)	09/06/2019 - 13/07/2019	Japan
13	Dr. H.A.G.Jayathissa Mrs. E.J.M.P.H. Jayasundara	Act. Director Scientist	LRRMD	Invitation to attend the International Conference on "Silk - roads Disaster Risk reduction & sustainable Development"	11/05/2019 - 17/05/2019	China
14	Dr. Asiri Karunawardhana Mr.K.C. Sugathapala	Director General Director	General HSPTD	BRCA Workshop in Maldives	15/07/2019 - 16/07/2019	Maldives
15	Mr. R.M.S.A.K. Rathnayaka	Scientist	LRRMD	"Early Warning System for National Disasters"	22.08.2019 - 11.09.2019	Korea
16	Mrs. AD.H.J.Perera	Scientist	LRRMD	Master Degree Program in "Environmental Science in University of Tsukuba, Japan from 21 <sup>st</sup> August to October 2021.	21st August - 2021 October	Japan
17	Dr. Wasantha Senadheera Mr. Dhanushka Jayathilaka Mr. D.I.U. Jyawardhana Mr. Jayaprakash Selvaraj Mr. D.M.L Bandara	Scientist	LRRMD HSPTD	Counterpart Training Under the JICA Technical Cooperation Project for " Capacity Strengthening on Development of Non – structural Measures for Landslide Risk Reduction " in Sri Lanka – (TCLMP 2) from 1 <sup>st</sup> to 14 <sup>th</sup> September 2019.	1st to 14th September 2019.	Japan
18	Mr. P.H.C.S. Rathnasiri	Senior Scientist	HSPTD	Subject: Letter of Invitation to be a panelist at Re – Naturing through Nature Based Solutions for a Resilient Future"	3 <sup>rd</sup> September 2019	Bangkok, Thailand
19	Mr. N.W.A.M.M.K.N. Bandara Mr. H.D.S. Premasiri	Director (Technical) Senior Scientist	GETD ESSD	Study Tour to South Korea- Nanjido and Sudukoan Eco Park Project	from 16th September 2019 to 22nd September 2019.	South Korea
20	Ms. M. S. N. De Zoysa Mr. P.G.D.S. Jayawickrama	Scientist	LRRMD HSPTD	2019 Seminar on "Disaster Response & Risk Management For Sri Lanka"	16th October to 5th November 2019,	China
21	Eng.Dr. Asiri Karunawardena	Director Genaral		12th Asia Oceanic Group on Earth Observations (AOGEO 2019) Symposium	31.10.2019 - 08.11.2019	Canbera, Australia
22	Dr. H.A.G.Jayathissa	Act. Director	LRRMD	Second South Asia Regional Hydromet Forum (SAHF II)	18.11.2019 - 22.11.2019	Nepal.
23	Dr. H.A.G.Jayathissa	Act. Director	LRRMD	International Symposium on "Disaster Risk Reduction"	12.12.2019 - 16.12.2019	China

## PROCUREMENT OF EQUIPMENT

The grant of LKR 20.0 Mn. given by the General Treasury in 2019 to procure laboratory and field equipment for research for capacity building in NBRO was effectively utilized. Several major equipment including field accessories and important IT related equipment were procured under this grant. The key items are listed in the following table.

Division	Item
BMRTD	Digital pull off (bond) strength tester, Pycnometer, Chloride Combination Electrode, with temperature sensor, Diamond concrete core drill bit, Electronic (buoyancy) balance, Dial gauges, Dial gauge holders, Electromagnetic sieve shaker, PH meter, Digital thermometer with thermocouple
ESSD	Digital thermometers, Laboratory sieve shaker, Ultrasonic water bath, Air sampling pump, Filter holder, Acetone vapour generator, Air purifier
HSPTD	3-d printer, rebound hammer, Auto level, Light and AV Digital Adaptor, Duplo machine
GED	DCPT apparatus, Mackintosh apparatus, Liquid limit device, Data logger for triaxial machine, Brenton Compass, GPS, Levels, Geotechnical mapping software, Core bits, Dip meters,
LSSD	Compasses, hammers and tapes
PMD	SLR camera 3 nos.



## Auditor General's Report 2019

The Director General  
National Building Research Organisation

### Report of the Auditor General on the Financial Statements of the National Building Research Organisation for the year ended on 31<sup>st</sup> December 2019 in terms of Section 12 of the National Audit Act, No. 19 of 2018.

#### 1. Financial Statements

##### 1.1 Qualified Opinion

This report states my opinion and observations that I consider as required to be published with the Annual Report of the National Building Research Organisation as per the regulations in Section 12 of the National Audit Act, No. 19 of 2018 read in conjunction with the Article 154 (1) of The Constitution of Democratic Socialist Republic of Sri Lanka on the Financial Statements of the National Building Research Organisation for the year ended on 31<sup>st</sup> December 2019 comprising of Statement of Financial Position as at 31<sup>st</sup> December 2019, Statement of Financial Performance, Statement of Changes of Equity, the Cash Flow Statement for year ended and a statement of concise important accounting policies. My report will be tabled at the Parliament as per the Section 154 (6) of the Constitution.

I am in the opinion that except for the effects of matters described in qualified opinion in my report, Financial Position of the National Building Research Organisation as at 31<sup>st</sup> December 2019, Financial performance and Cash Flow for the year ending on that date are in accordance with the Sri Lanka Public Sector Accounting Standards and reflect a true and fair situation.

##### 1.2 Foundation for qualified opinion

- (a) According to financial policies of the organisation on allocating for unrecoverable / bad debts / outstanding, a 25% of the debts / outstanding over 10 years should be allocated as unrecoverable debts / outstanding. But an allocation of Rs. 1.39 Mn for the bad debts / outstanding over 10 years amounting to Rs. 5.55 Mn has not been made.
- (b) Buildings have not been rented as offices of the risk reduction by stabilisation project but Rs. 1.81 Mn has been deducted as a project expense from rent allocation of the organisation and shown in the Financial Statement. As a result, rent of buildings less this amount has been shown in the Financial Statement for the year under consideration.
- (c) As per the Section 48 of the Sri Lanka Public Sector Accounting Standards, revenue and expense cannot be set off. But the total of Rs. 27.87 Mn in Other Expenses has been set off with Rs. 15.31 Mn received from the Treasury as funds for Research and Development and only the difference of Rs. 12.56 Mn. has been shown as Other Expenses in the Financial Statement.
- (d) As per the Paragraph 76 of Section 1 of the Sri Lanka Public Sector Accounting Standards, realised assets that are received within a year should be shown under Current Assets. But Fixed Deposits of the Organisation amounting to Rs. 463.89 Mn that have been invested for periods more than one year have been shown under Current Assets.
- (e) A sum of Rs. 1.52 Mn that has been transferred to Head Office by District Offices has been shown under Current Liabilities instead of adjusting in respective accounts.
- (f) As per the Section 15 of the Sri Lanka Public Sector Accounting Standards, information on Revenue and Expenses has not been disclosed in the Financial Statement.

I conducted this audit in accordance with Sri Lanka Auditing Standards (SLAuS). My responsibility under these auditing standards has been further described under the heading Auditors responsibility. I believe that audit evidence obtained is sufficient and appropriate to provide a basis for my audit opinion.

### 1.3 Responsibility of the management and administration on the Financial Statements

It is the responsibility of the management to prepare these financial statements in accordance with Sri Lanka Public Sector Accounting Standards and present in a fair manner and decide on such internal controls as the management determines is necessary to enable the preparation of financial statements that are free from material misstatements whether due to fraud or error.

It is the responsibility of management to decide on the sustainability of National Building Research Organisation when preparing financial statements, and it is the responsibility of management to keep accounts on the basis of uninterrupted sustainability and declare matters pertaining to uninterrupted continuity of National Building Research Organisation except in the case if the management decides on termination of National Building Research Organisation or if there is no other alternative except for suspending its operations.

Parties administrating bear the responsibility of financial reporting activity of National Building Research Organisation. The books and records on own income revenue, expenditure, assets and liabilities should be properly maintained enabling the preparation of annual and periodical financial statements of the National Building Research Organisation according to Subsection 16(1) of the National Audit Act, No. 19 of 2018.

### 1.4 Auditor's Responsibility on auditing of financial statements

My responsibility is to give a fair judgement that financial statements are free of material misstatements whether due to fraud or error and issue audit report inclusive of qualified opinion. Fair certification is a higher certification but, when auditing according to Sri Lanka Auditing Standards it does not guarantee that material misstatements are always sufficiently disclosed. Effect of fraud and error singly or together can result in significant material misstatements and it is expected that economic decisions taken on the basis of these financial statements can be affected.

I have audited with professional judgement and professional scepticism according to Sri Lanka Auditing Standards.

- When identifying and assessing, planning of audit actions timely and appropriately can alleviate the risk of quantitative material misstatements in financial statements due to fraud and error. And in order to do so, obtaining sufficient and suitable evidence is necessary to base my opinion. The effect of fraud is higher than the effect of significant material misstatements and joint corruption, forging documents, intentional neglect, or disregarding internal controls results in a fraud.
- Internal controls of National Building Research Organisation were studied in to order to plan audit actions timely and appropriately but it is not expected to state an opinion on the effectiveness of these internal controls.
- Evaluation of the suitability of accounting policies and accounting estimates used, and the associated disclosures of the management
- Based on the audit evidence related to the significant doubt on the sustainability of National Building Research Organisation due to incidents and situations, the appropriateness of using sustainability of the organisation as a base in accounts was decided. If I decide that there is a significant doubt, my audit report should focus on associated disclosures in financial statements, and if such disclosures are insufficient, my opinion should be rejected. However, sustainability may end based on future incidents and situations.
- Presentation of financial statements containing disclosures, structure and contents were assessed and evaluation of appropriateness and fairness in the inclusion of related transactions and incidents in financial statements

The management was apprised on important audit findings, main weaknesses in internal control and other facts identified in my audit.

## 2. Report on other Legal and Regulatory Requirements

Special provisions on the following requirements are given in the National Audit Act No.18 of 2018.

- As per the requirements in Section 12 (a) of the National Audit Act No.19 of 2018 except for the effects by reasons mentioned in the basis of my report, all information and explanations required for the audit were obtained by me, and according to my investigations, proper financial statements have been maintained at the National Building Research Organisation.
- As per the requirements in Section 6 (1) (d) (iii) of the National Audit Act No.19 of 2018, financial statements of National Building Research Organisation are in line with previous year
- As per the requirements in Section 6 (1) (d) (iv) of the National Audit Act No.19 of 2018, my recommendations given in the previous year have been included in the financial statements presented

Based on the methodologies followed and evidence obtained, and after limiting to significant facts, there were no evidence to state the following statements that drew my attention.

- That, as per the requirements in Section 12 (d) of the National Audit Act No.19 of 2018, a member of the governing board is having directly or otherwise an involvement outside common business norms regarding an agreement of the National Building Research Organisation.
- That, as per the requirements in Section 12 (f) of the National Audit Act No.19 of 2018, except for the following observation, acted against any written law or other common or specific regulation issued by the governing board of the National Building Research Organisation.

Reference to laws and regulations	Description
(a) Clause 10.1 of Section VIII in Code of Establishment revised by Public Administration Circular No. 21/2013 dated 09 <sup>th</sup> October 2013	Approval of Secretary of the Ministry is required for staff to work more than two days on weekends and on government holidays. However, Rs. 6.13 Mn had been paid to staff working more than two days without such approval and Rs. 918,920 had been paid to Employees Provident fund and Employees Trust Fund.
(b) Clause 7 of Section VIII in Code of Establishment	Approval of Secretary of the Ministry is required for paying for overtime in the excess of 20 hours per month to staff grades entitled to overtime payment. However, overtime in the excess of upper limit had been paid without the approval of Ministry Secretary
(c) Section 13.2 of the Management Services Circular No. 02/2016 dated 04 <sup>th</sup> April 2016	On the contrary to Subclause 6.1 in Section VII of Establishment Code, rates of overtime payment had been decided and overtime payment had been made, and the organisation had paid Rs. 8.83 Mn as overtime payments in 2019 and paid in excess Rs. 1.32 Mn to Employees Provident Fund and Employees Trust Fund
(d) Financial regulation of the Democratic Socialist Republic of Sri Lanka Section 104.	Due to discrepancies in stock controls a difference of Rs.400,824 between values of physical stocks & balance amount in stock controls was observed. Action had not been taken to bridge this loss according to said regulation.

As per the requirement in Section 12 (g) of the National Audit Act No.19 of 2018, except for the following observation, not acted beyond powers, functions and duties of the National Building Research Organisation.

As per the requirement in Section 12 (h) of the National Audit Act No.19 of 2018, except for the following observations, the resources of National Building Research Organisation had been procured according to rules and regulations and used thriftily, efficiently, and productively within the set time limits.

- (a) The contract of new office and laboratory building under construction had been extended without a justifiable reason giving a 623 day extra period, and delay charges amounting to Rs. 1.62 Mn had not been recovered. Rs. 43.12 Mn had been paid as Deviations of the Bill of Quantities of the Contract but approval of the Secretary of the Ministry as per Clause 8.13.4 of the Procurement Guide had not been obtained. A sum of Rs. 6.36 Mn had been paid as rent and for security services of buildings rented to operate some functions of the organisation in 2019 because of the delay in constructing the building, and Rs. 9.60 Mn had been paid additionally to officers of the organisation associated with construction work for their contribution.
- (b) When procuring vehicles for Head Office, the lowest bidder had been disqualified incorrectly as black-listed and the organisation had to bear additional expenditure amounting to Rs. 5.47 Mn annually by awarding contract to a different institution. Also, a cab hired at a rate of Rs. 132,000 per month from the institution supplying vehicles to District Offices had been stopped and another cab at a rate of Rs. 185,000 per month had been hired from the institution supplying vehicles to Head Office and as result, the organisation had to additionally pay Rs. 636,000 annually.

### 3. Other Audit Observations

- (a) Approval was given on 2<sup>nd</sup> June 2010 to the Cabinet Memorandum on drafting an act to give legal status to the research organisation and a draft prepared to this effect was sent to the Legal Draftsman's Department on 10<sup>th</sup> September 2012. But even by 31<sup>st</sup> December 2018, actions have not been taken to present this act to the parliament.
- (b) Contractors who were awarded Landslide Mitigation Project contracts on Pussala Navodya Vidyalaya and Badulla - Wawegama Hospital premises had abandoned contracts in 2016. Actions have not been taken to recover Rs. 1.66 Mn from the advance and Rs. 1.57 Mn from the Performance Bond even by 31<sup>st</sup> December 2019 to minimize the loss to the organisation.
- (c) Rs. 200 Mn had been provided to the organisation by the Treasury for implementation of landslide risk reduction projects in the year under consideration. Out of that a sum of Rs. 35 Mn. had been invested for special geological investigations unrelated to above purpose. Balance amount had been utilized to implement 8 projects and after preparing an estimate of Rs. 160.18 Mn., contracts worth of Rs. 132.92 Mn. had been awarded. Even though construction in said 8 projects should have been completed by 28<sup>th</sup> February 2020 these had not been completed.
- (d) The organisation received a contract to conduct basic geotechnical investigation on either bank of Kelani River from Kaduwela to Hanwella. A subcontractor had been appointed to conduct cone penetration tests by a limited invitation of bids. Selection of institutions for calling OR INVITING bids and bid opening had not been conducted in a transparent manner and appointing an external member for the Technical Evaluation Committee as per Clause 2.8.4 (d) of the Procurement Guide had not been done. A Performance Bond as per Clause 5.4.8 of the Procurement Guide had not been obtained and Rs. 1.4 Mn had been paid in addition to agreed value of Contract.
- (e) The sum of Rs. 7.62 Mn received in 2015 from United Nations Development Programme for the implementation of community based landslide mitigation programme had not been invested by 31<sup>st</sup> December 2019 on related work and the sum of Rs. 5.00 Mn received from the Treasury in 2015 to Landslide Risk Reduction Division for Digital modelling programme had not been invested even by 31<sup>st</sup> December 2019.
- (f) A sum of Rs. 5.92 Mn had been shown as outstanding from Urban Development Authority in financial statements continuously since 2009. But it was observed that such sum had not been shown as a balance payable in the financial statements of the Authority and hence recovery seemed to be uncertain. Also, actions had not been taken to recover by 31<sup>st</sup> December 2019



tender deposits receivable by the organisation amounting to Rs. 575,722 and the sum of Rs. 477,882 receivable from Pradeshiya Sabhas for issuing Landslide Risk Assessment Reports.

- (g) Actions had not been taken to clear tender deposits from 2014 to 2018 amounting to Rs. 991,152.
- (h) Provision of services on a post-paid basis not a policy of the organisation, but Rs. 4.08 Mn. and Rs. 23.14 Mn. had been outstanding by 31<sup>st</sup> December 2019 respectively for services provided by Environmental Studies Division and Services Division and Geotechnical Engineering Division in the year under consideration. Actions have not been taken to recover the sum of Rs. 37.50 Mn. due for two years 2018 and 2019.
- (i) The Nation Building Tax payable by the organisation is Rs. 1.12 Mn as per the Tax records prepared by the organisation on Nation Building Tax but this had been shown in the Financial Statement as Rs. 2.54 Mn. receivable from Commissioner of Island Revenue. Also the value added tax that can be claimed for year under consideration is Rs. 7.31 Mn. according to value added tax records of the organisation, but this value had been shown as Rs. 10.06 Mn in the Financial Statement.
- (j) The approved cadre of the organisation is 386 by 31<sup>st</sup> December 2019, but staff on duty was 459. Out of this 117 are officers do not belong to permanent cadre.

W. P. C. Wickremaratne  
Auditor General



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